EXHIBIT "25"

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

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6 January 2004
File No. 10063-074

Department of Environmental Protection
Northeast Regional Office
1 Winter Street
Boston, Massachusetts 02108

Attention: Mr. Jack Miano

Subject: Phase II Comprehensive Site Assessment for the Presence of Asbestos
W.R. Grace & Co.-Conn
62 Whittemore Avenue
Cambridge, Massachusetts
RTN 3-0277, Tier IC Permit No. 118529

Ladies and Gentlemen:

On behalf of W.R. Grace & Co.-Conn. (Grace), we are pleased to submit this Phase II Comprehensive Site Assessment (CSA) Report for the presence of asbestos at the Grace site (the "Site") located at 62 Whittemore Avenue and One Alewife Center in Cambridge, Massachusetts. This document summarizes data collected during Phase II CSA activities conducted in accordance with a Phase II CSA Scope of Work (SOW) prepared for the Site, dated 27 April 1999. This Phase II serves as an addendum to the original Phase II CSA equivalent and risk characterization prepared for the Site in 1988 and 1989.

The Site was assigned Massachusetts Department of Environmental Protection (DEP) Release Tracking Number (RTN) of 3-0277 in 1987. In a letter to Grace dated 2 March 1990, the former Department of Environmental Quality Engineering (DEQE, now the DEP) stated that environmental conditions at the Site had been sufficiently characterized and that procedures to estimate exposure and evaluate risks had been adequately documented. Therefore, the DEQE considered the Phase II Comprehensive Site Assessment to be complete.

The Site was classified as a Tier IC disposal site with a Tier IC permit effective 13 February 1997. In June 1998 a second RTN (RTN 3-17014) was assigned as a result of the detection of asbestos in soil at the Site. In June 1999, H&A prepared a document that proposed linking RTN 3-17014 to the existing Tier IC Classification. On 13 July 1999, RTN 3-17014 was closed by the DEP and the compliance obligations under this RTN were rolled into existing compliance obligations under RTN 3-0277. The current Site permit (Permit No. 118529) has been extended through 25 February 2004. The Site has a Public Involvement Plan (PIP) prepared in 1995 with input from the Department of Environmental Protection (DEP) and interested parties.

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In a memorandum prepared by DEP dated 31 July 2000, DEP indicated the 1988 risk characterization (prepared by Meta Systems, Inc.) was no longer adequate for the Site, given the detection of asbestos in soil at the site in 1998. DEP further indicated that data for the Site (the asbestos data and other contaminant data) generated since the completion of the 1988 risk assessment and Phase II CSA (i.e. 1998 report prepared by Haley & Aldrich entitled "Environmental Data Report") needs to be incorporated into risk calculations for the Site.

Haley & Aldrich has prepared this Phase II CSA for the Presence of Asbestos. Results of the Phase II characterization for asbestos and the evaluation of risk due to the presence of asbestos at the Site are presented in the following sections of this document. The Phase II CSA and risk characterization (presented in Appendix F) evaluate only asbestos. It is understood that a re-evaluation of total site risk, considering new data for other contaminants at the Site is still required and it is our intention to address this as a part of a Response Action Outcome (RAO) report, at the appropriate time.

A public comment Draft of the Phase II SOW was submitted to the DEP and the established PIP repositories for public comment. Additionally, the contents of the Phase II SOW were presented at a public meeting held by Grace on 17 June 1999. Public comments on the document were accepted for an extended period for 20 days after the public meeting.

A public comment Draft of this Phase II CSA for the Presence of Asbestos was submitted to DEP and the established PIP repositories for public comment for 20 days, starting 26 November and ending at the end of day on 15 December 2003. On 15 December 2003 one comment letter was received. In this letter the commenter requested that the comment period be extended for an additional week. In response to this request, the comment period was extended to the end of the day on 22 December 2003. Copies of the comments received and responses to those comments are included in Appendix G of this report.

An original Comprehensive Response Action Transmittal Form (BWSC 108) is being submitted along with this Phase II Report. A copy of the form is included in Appendix A of this Report.

Please do not hesitate to contact us should you have any questions concerning this report.

Sincerely yours,
HALEY & ALDRICH, INC.

Melissa M. McEwen
Senior Environmental Geologist

William W. Beck, Jr., LSP
Senior Vice President

Enclosures

c: W.R. Grace & Co.-Conn.; Robert F. Jenkins

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EXECUTIVE SUMMARY

This Phase II Comprehensive Site Assessment for the Presence of Asbestos has been prepared for the subject site, in accordance with 310 CMR 40.0830. The disposal site (the "Site") includes the 24-acre W.R. Grace & Co.-Conn. (Grace) property located at 62 Whittemore Avenue and the adjacent 1-acre One Alewife Center property in Cambridge, Massachusetts (Figures 1 and 2).

In 1998 Grace voluntarily undertook two sampling programs to investigate for the potential presence of asbestos in soil at the Site. The investigations were conducted in response to concerns raised by community members about the potential presence of asbestos at the Site and potential exposures to such material in the event the Site was redeveloped. The findings of these investigations indicated the presence of asbestos in soil at the Site.

The purpose of this Phase II CSA was to evaluate the potential presence and extent of asbestos fibers in soil, groundwater, surface water, sediment and ambient air at the W.R. Grace Site and define potential migration pathways for the asbestos. This Phase II also presents the information needed to address concerns outlined by the Department in a 3 September 1998 letter regarding the presence of asbestos fibers at the W.R. Grace Site and a 31 July 2000 Memorandum regarding the applicability of the risk characterizations previously completed for the Site.

The results of the Phase II CSA for Asbestos indicate that asbestos fibers are present in soil samples at various quantities. Minimal quantities of small pieces of non-friable ACM are also visible on the soil surface in limited areas of the property. Asbestos fibers have also been identified in surface water samples collected from Jerry's Pond and in groundwater samples collected at the Site. Asbestos fibers have not been identified in the sediments from Jerry's Pond. Much of the Site soils are covered with pavement and or landscaping, thus fibers in the soil are unlikely to become airborne. Based on ambient air monitoring data, asbestos fibers identified in the soil are not being released into the air.

The property has had an industrial use from the early 1920s, when Dewey & Almay began operations at the Site, until 1983, at which time Grace ceased all manufacturing and processing at the Site. Building debris and other materials are present in the soil at the Site as a result of demolition activities associated with the decommissioning of the former Grace facility from 1976 through 1981. Based on the known historic uses of the Site, the presence of asbestos in soil is most likely attributable to the release of fibers during the demolition and decommissioning of these buildings. The nature and extent of contamination is also attributable to the location of the Site in an urban environment and its proximity to a busy four-lane highway. Asbestos may also have been used by Dewey and Almy at the Site in conjunction with pilot-scale brake research operations in the 1930s. These pilot-scale operations may have involved a pilot production line for manufacturing a type of brake lining that was molded with asbestos and latex and are believed to have occurred in former Buildings 11 and 12. Additionally, in the late 1960s and early 1970s, Grace conducted laboratory analysis and research on small amounts of asbestos-containing fireproofing materials.

However, these uses of asbestos are thought to have been small in scale and likely did not result in a release of asbestos to the soil, groundwater or surface water at the Site.

Based on the data collected and historical use of the property, Haley & Aldrich concludes that there is no reason to suspect that bulk disposal of asbestos has occurred at the Site. The data and historical use of the Site support the conclusion that the asbestos contamination at the Site is most due to the demolition of structures that had asbestos containing materials.

An evaluation of risks to human health, safety, public welfare and the environment due to a release of asbestos at the Site was completed as a part of the Phase II CSA, in accordance with guidelines provided in the MCP, the Guidance for Disposal Site Risk Characterization in Support of the MCP (DEP Risk Guidance), and current risk assessment practices in Massachusetts. Evaluation of Site risk under existing conditions has resulted in a finding of No Significant Risk to human health, safety, public welfare and the environment. For foreseeable future conditions, the Site is likely to continue to be used in a manner consistent with its current use as a commercial facility. However to be conservative, the Risk Characterization included a hypothetical future construction scenario. Under the hypothetical construction scenario, the incremental cancer risk estimates for the adjacent resident, the office workers, and the hypothetical construction worker potentially exposed to soil at the Site exceed DEP's guidelines for achieving a condition of No Significant Risk. However, an Activity and Use Limitation can be implemented to provide acceptable limits of risk of harm resulting from these potential exposures to Site soils, through implementation of a health and safety plan and a soil management plan, during activities that may result in soil disturbance. With an Activity and Use Limitation, the Risk Characterization identified a condition of No Significant Risk of harm to human health, safety, public welfare, and the environment at the Disposal Site for current and foreseeable future use.

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The area south of the Site and Rindge Avenue is occupied by Rindge Towers, a high-rise residential apartment complex. The Massachusetts Bay Transit Authority (MBTA) Alewife station and commercial properties occupy the area on the west side of Alewife Brook Parkway. The MBTA maintains an easement on the Grace property on which an MBTA Red Line access building, a surrounding paved area, and a walkway to Russell Field are located (Figure 2).

Historically, the majority of the Site had been occupied by up to 46 buildings distributed over approximately two-thirds of the Site, since initial development in the early 1900s. A description of property ownership and uses is presented in Section 1.3 entitled "Site History".

The topography of the Site is slightly undulating, resulting from the presence of foundations of former buildings, the placement of excess soil generated from demolition and site re-grading activities in the last 20 years, and from remediation activities conducted in the 1980s. According to the USGS 1:25000 (metric) Boston North Massachusetts quadrangle, dated 1985, the Site is located at approximately 9 ft to 11 ft above sea level. Jerry's Pond is located on the southern portion of the Site, north of Rindge Avenue. Jerry's Pond is a man made water body, created as a result of clay mining activities in the mid-1800s.

1.3 Site History

1.3.1 Site Ownership History

Land in the vicinity of the Grace property was cleared of trees in the 17th century and used as pasture for oxen. The property was located near an area once known as the Great Swamp, a wet environment that resulted from the deposition of fine-grained clay sediment in the Cambridge Fresh Pond area. The clay deposits were discovered in the early to mid-1800s, and mined by two clay mining companies, Hubbel and Bay State Brick. Due to high water table conditions in the area of the W.R. Grace property, mining operations were abandoned in the late 1800s and the open pits were left to fill with water, resulting in the formation of Jerry's Pond and Yates Pond. Jerry's Pond was used as a bathing area in the summers during the 1900s, and a bath house owned by the COC was once located east of Jerry's Pond during this time.

In the 1900s, the Boston and Maine Railroad tracks ran through the Site from roughly east to west (Figure 3). In 1919, the Dewey and Almy Chemical Company was founded at the Site and began constructing buildings for their rubber product manufacturing processes (a brief discussion of these processes is included in the Section 1.3.2 entitled "Historic Site Operations"). Buildings 1 through 11 had been built just north of the Boston & Maine Railroad tracks by 1930. The Dix Lumber Company was in operation south of the Boston & Maine tracks. A 1949 aerial photograph shows buildings belonging to Dewey and Almy (Buildings 18, 22, 23, 24 and 29) present on the south side of Whittemore Avenue and Building 28 present on the north side of Whittemore Avenue. The majority of the buildings historically located south of the Boston & Maine Railroad on Dewey and Almy property were constructed prior to the 1949 photograph and the remaining buildings were constructed by 1955 as evidenced by a later aerial photograph. In total, 46 buildings historically occupied the Site.

Grace acquired Dewey and Almy in 1954. The property acquired with this business acquisition included land from the south side of Whittemore Avenue to just north of Jerry's Pond.

From 1954 to 1965, Grace acquired the following properties to achieve the current property size (Figure 2):

- Jerry's Pond
- Parcel of land between Jerry's Pond and Russell Field Park (from the COC)
- Portion of lot now known as One Alewife Center
- Parcel north of Whittemore Avenue
- Lot south of the Boston & Maine Railroad tracks, formerly the Dix Lumber Company

During the 1960s and 1970s, W.R. Grace was expanding nationwide, and the company was split into operational divisions. The Grace Cambridge facility was used as a headquarters and research facility for the four new divisions of the company, three of which were moved from the Cambridge facility to the Lexington facility in 1976. The demolition of unused manufacturing buildings at the Cambridge property began around 1976 and continued to 1981. The current configuration of buildings on the Site was achieved in 1981, with 169,300 square ft (approximately 4 acres) of building footprint.

The Massachusetts Bay Transit Authority (MBTA) constructed the Red Line extension through the Grace property from the late 1970s through mid-1980s. The MBTA obtained an easement from Grace to construct train line tunnels and an entrance structure. The MBTA Red Line extension tunnels were excavated in an area formerly occupied by process waste and settling ponds resulting from the manufacturing processes. Existing information indicates the MBTA was responsible for stabilizing and removing all excavated material, associated with the development of the MBTA Red Line tunnel and associated Alewife station, from the property.

The last parcel of land to be added to the Grace property was a residence located south of Whittemore Avenue, on a portion of the property now occupied by the One Alewife Center building. Grace purchased the residence and parcel, and moved the residence to a new location. Construction of the One Alewife Center building began in 1988. One Alewife and the associated parcel of land beneath it was sold in 1999 to New Boston Alewife Limited Partnership. The extent of the property currently owned by Grace has not changed since 1999.

1.3.2 Historical Site Operations

The Dewey and Almy facility originally manufactured materials used as can sealing compounds, drum and pail cover gaskets, and bottle cap gaskets. The primary raw material was processed rubber. To assist in dispersing the rubber in water, naphthalene sulfonate (trade name DAXAD) was manufactured on-site. Due to Dewey and Almy's research and development in dispersants, they began manufacturing and selling various dispersants to other companies. DAXAD was used in the production of paints and other water-based materials. Another dispersant (trade name TDA) was used in the manufacture of cement. Its raw material was calcium lignosulfonate, a by-product of the paper-making industry. Dewey and Almy also manufactured Soda Sorb, a material used as a carbon dioxide absorbent using processed lime as the primary raw material. Products produced by the Dewey and Almy Company also included meteorological balloons and synthetic leathers for shoes.

Grace had ceased all manufacturing and processing at this location by 1983. Following the end of chemical manufacturing in 1983, the Boston & Maine railroad spurs were removed from service. Currently, the only industrial operations at the Site are conducted in a small machine shop. The machine shop produces equipment for customers that utilize Grace's FDA approved can sealing compounds to seal food and beverage cans.

1.4 Site Regulatory History

1.4.1 Initial Identification as a Disposal Site

In 1985, Grace assigned the ownership of 17.5 acres of the property to Alewife Land Corporation (a wholly owned subsidiary of Grace). This 17.5-acre parcel included the western portion of the site, extending from One Alewife Center (as it is now known) to Jerry's Pond. As part of a plan to develop portions of the property, Grace voluntarily conducted an assessment to evaluate the subsurface and hydrogeological conditions at the property. The assessment report, entitled "Environmental Site Assessment Report for the Proposed Alewife Center Development," was completed in 1985 and included explorations and data for the entire 27-acre Grace property (not just the 17.5 acre portion initially proposed for development). The report was submitted to the Massachusetts Department of Environmental Quality and Engineering (DEQE), which is now the Massachusetts Department of Environmental Protection (DEP).

The DEQE reviewed the assessment and other available information and concluded further information was necessary in order to address DEQE concerns regarding contaminants at the Site. At that time, the COC and W.R. Grace requested that the DEQE be actively involved in the redevelopment studies for the property.

Six building sites had been proposed for development on the 17.5-acre portion of the Grace property assigned to Alewife Land Corporation. Two subsurface exploration programs, conducted in November 1986 and October 1987, provided environmental information on soil and groundwater in the area of the proposed building sites. The data compiled from these two reports was used to perform an extensive risk assessment to evaluate transport pathways and receptors for the use of the property at the time, and for the proposed post-development

conditions. This Risk Characterization completed by Meta Systems Inc., in 1988 is summarized in the following section.

After reviewing the results of subsurface and hydrogeological evaluations conducted in 1984 and 1985, the DEQE issued a Notice of Responsibility (NOR) on 9 February 1987, notifying Grace that the DEQE had determined that a release of oil or hazardous materials (OHM) had occurred at the 27-acre Grace property. DEQE assigned Site Number 3-0277 to the Grace Site and required additional investigations.

1.4.2 Compliance Activities for Non-Asbestos Oil and Hazardous Materials (1987-2000)

Original Notice of Responsibility for Non-Asbestos Contaminants

The original NOR issued by the DEP in 1987 required Grace to take actions to specifically define the nature and extent of oil or hazardous materials that might exist on site, and evaluate how such materials would be treated if they posed an unacceptable risk to human health or the environment. The NOR listed the following thirteen (13) required actions to be taken by Grace:

1. Locate and evaluate possible sources of contamination;

2. Develop "worst case" concentration estimates where sampling data do not exist;

3. Prepare a sampling plan that documents sampling locations, sampling procedures, and chemical analyses to be performed;

4. Validate all available chemical analysis data;

5. Implement a long-term monitoring program to characterize groundwater quality on-site on a quarterly basis for one year;

6. Predict the groundwater flow direction and rate after construction of Alewife Center;

7. Evaluate the effect of underground utilities on contaminant transport;

8. Evaluate the potential for contaminated groundwater from the Site to enter basements of nearby residential buildings and conduct a long-term monitoring program using shallow wells along Whittemore Avenue;

9. Perform a human health risk assessment that evaluates all possible transport pathways and receptors under existing and developed conditions;

10. Prepare a Feasibility Study Report that evaluates and recommends remedial action alternatives;

11. Prepare a Remedial Action Plan that details soil and groundwater treatment;

12. Prepare a Hazardous Material Management Plan that proposes methods to monitor and control additional releases of oil or hazardous materials during excavation and construction activities;

13. Develop a monitoring and treatment plan if building design requires dewatering to be continued indefinitely or permanently.

Original Phase II CSA and Risk Assessment for Non-Asbestos Contaminants (1988)

Haley & Aldrich prepared a report entitled "Environmental Data Report", dated 29 April 1988, on behalf of Grace to respond to items 1 to 4 listed above.

The risk assessment required by the NOR was completed by Meta Systems, Inc. (Cambridge Environmental, Inc. is a division of Meta Systems) in 1988 (Item 9). The risk assessment concluded that contaminants of concern present at the Site, namely naphthalene and petroleum hydrocarbons (evaluated as "oil and grease"), presented negligible long term or acute risks to the health of Site workers, casual Site users or neighbors. The report also concluded that the other contaminants detected at the Site posed negligible long-term risks, and that Site contaminants had caused negligible effects to the environment.

The DEP issued the original Massachusetts Contingency Plan (MCP) effective 31 August 1988. In response, Meta Systems issued an addendum to their 1988 risk assessment report. The August 1989 addendum presented a reevaluation of the original 1988 risk assessment based on newly promulgated MCP criteria. The reevaluation confirmed:

1. no Exposure Point Concentration exceeded applicable public health standards,
2. no Hazard Index exceeded the Total Site Non-Carcinogenic Effects Risk of Limit of 0.2, and
3. the Total Site Cancer Risk estimate is not greater than the Total Site Cancer Risk Limit of 1.0×10^{-5}.

As a result of the reevaluation, it was concluded that the Site poses no significant threat to human health or the environment.

At the time the Site was transitioned into the MCP, the 1988 Environmental Data Report, in conjunction with the risk assessments described above, were considered to be the equivalent of a Phase II level of site characterization. In a letter to Grace dated 2 March 1990, the DEQE stated that environmental conditions at the Site had been sufficiently characterized, that procedures to estimate exposure and evaluate risks had been adequately documented, and that the DEQE considered the Phase II Comprehensive Site Assessment to be complete.

Groundwater Monitoring (Items 5 to 8)

Long-term monitoring has been conducted at the Grace facility since the late 1980s. A long-term groundwater monitoring program was implemented in 1987 in response to items 5 to 8 listed above. The program includes periodic monitoring of groundwater and surface water for volatile organic compounds (VOCs) and naphthalene as requested by the COC and the

Massachusetts Department of Environmental Protection (DEP) in anticipation of the redevelopment of the property. The Site has not been developed, however Grace has continued to conduct annual and/or semi-annual groundwater monitoring.

For the first year, groundwater quality data was collected every three months. After the first year of monitoring, the sampling interval was reduced to two rounds of data collection per year, until 1994. Grace continued sampling beyond 1994. Groundwater sampling events were conducted in 1994, 1998, 1999, 2000, 2001, and 2002. From 1987 through 2002, twenty-two rounds of groundwater sampling have been completed at the Site.

Phase III Feasibility Study for Non-Asbestos Contaminants (1988 and 2000)
(Items 10 and 11)

A Phase III Feasibility Study was completed and submitted to the DEP in 1988. After reviewing the 1988 Environmental Data Report and the Meta Systems Risk Characterization, the DEP was satisfied that there was not a public health risk at the Site and chose to remove the DEP staff assigned to the project. Therefore, the original 1988 Phase III report was not reviewed by DEP.

Subsequent to the initial subsurface and hydrogeologic evaluations in 1984 and 1985, additional investigations were completed to further assess the nature and extent of contamination at the Site. In 1995, a supplemental soil investigation was conducted at the Site to further assess the nature and extent of Total Petroleum Hydrocarbon contamination using improved TPH analytical methods (TPH by Gas Chromatography/Flame Ionization Detector) to compare site-specific levels of TPH to the Upper Concentration Limit (UCL) standards. Analytical testing indicated total petroleum hydrocarbon (TPH) concentrations above Upper Concentration Limits (UCLs) in three soil samples of 165 samples tested. These samples were collected from borings installed adjacent to a former fuel oil storage area, beneath the asphalt parking area within the central portion of the Site, and within the bermed area north of the MBTA station. Analytical testing indicated TPH concentrations approaching UCLs in two additional soil samples.

In 1998, DEP established two new methods of evaluating the components of petroleum present in groundwater and soil. The new analytical methods, for extractable and volatile petroleum hydrocarbons (EPH and VPH), identify and quantify the aliphatic and aromatic fractions of petroleum. The DEP developed and promulgated new soil and groundwater cleanup standards for the aliphatic and aromatic fractions, which became effective on 31 October 1997. Final test protocols to determine EPH and VPH were released in January 1998 and became effective in April 1998.

The soil in the areas at the Site where sample analysis in 1995 indicated TPH UCL exceedences or high TPH concentrations, were re-evaluated using the EPH and VPH methods in 1998. Twenty-five (25) additional exploration locations and thirty-two (32) soil samples were obtained. EPH (C11-C22 carbon range) was detected in one sample at a concentration greater than the DEP UCL of 10,000 ppm. This sample was collected at location B98 at a depth of 4 to 6 ft below ground surface (bgs), with a concentration of 16,000 ppm. No other soil samples exceeded the applicable UCLs in any other carbon range when using either EPH or VPH analytical methods.

With the additional data, numerous changes to the MCP, a complete change in the proposed activities at the Site (no development), and the fact that DEP had not reviewed the original Phase III report, Haley & Aldrich submitted a new Phase III report to the Department in 2000. The second Phase III Feasibility Study and Remedial Action Plan (RAP) to address the exceedence of the EPH UCL was completed in February 2000. The goal of the Phase III RAP was to identify, evaluate, and select an appropriate remedial alternative considering the constituents of concern, the contaminated media, and site characteristics. The RAP presented an evaluation of five remedial alternatives to the concentrations of TPH in soil at the Site:

Alternative 1: Excavation/Off-site Landfill Disposal
Alternative 2: Excavation/Off-site Thermal Desorption
Alternative 3: Excavation/On-site Asphalt Batching/Reuse
Alternative 4: Engineered Barrier
Alternative 5: Enhanced In-Situ Bioremediation

Based on comments received during the public involvement plan document review process, Alternative 5, enhanced in-situ bioremediation was selected as the remedial action alternative for the area of elevated petroleum levels at the Site (vicinity of B98-3). Bioremediation was implemented at the Site under a Release Abatement Measure from 2001 to 2003.

<u>Bioremediation Release Abatement Measure</u>

On 18 July 2001 Haley & Aldrich prepared an Enhanced In-Situ Bioremediation Release Abatement Measure Plan (Bio RAM). The objectives of the Bio RAM consisted of the following remedial actions which have been completed:

- Further characterize the extent of UCL exceedance vertically and laterally in the vicinity of B98-3.

- Reduce the concentration of EPH in soil in the vicinity of B98-3 below the applicable UCLs using Enhanced In-situ Bioremediation.

Prior to installing and starting up the bioremediation system, Haley & Aldrich completed additional soil precharacterization and a baseline groundwater sampling and analysis program. A pre-characterization program was implemented to verify the vertical and lateral extent of contamination in the vicinity of B98-3. On 15 August 2001, six borings were completed by New Hampshire Boring in the vicinity of B98-3 (Figure 3). Soil samples were sent to Alpha Analytical in Westborough, Massachusetts for analysis of EPH carbon ranges with target analytes and percent solids. Groundwater samples were collected using low-flow techniques on 3 October 2001 from one upgradient (B601-OW) and one downgradient (B707-OW) well to establish baseline groundwater conditions. Samples were sent to Alpha Analytical for the following analyses: ammonia nitrogen, nitrate nitrogen, total phosphorus, heterotrophic plate count, and EPH plus naphthalene.

The samples were collected to compare upgradient and downgradient groundwater as baseline conditions. Results of the sampling indicate EPH carbon range C11-C22 aromatics and naphthalene were detected in the downgradient groundwater sample (B707-OW) but were not

detected in the upgradient groundwater sample (B601-OW) in the baseline groundwater sampling. Ammonia nitrogen and total phosphorus were detected in groundwater from both wells at similar concentrations. The upgradient groundwater sample contained a slightly higher heterotrophic plate count than the downgradient sample in the baseline groundwater samples.

Based on the results of the precharacterization work, a target area of contamination was identified. The initial injection of remedial additives was completed on 5 and 11 October 2001 with assistance from a representative from Enzyme Technologies, Inc. The mixed remedial additives were injected at an approximate rate of 9 gpm with an approximate water pressure of 34 psi. Subsequent injections were added in the same manner as the initial injection. (A detailed description of the BioBox system is provided in the original RAM Plan dated 18 July 2001 and specifics on system start up are provided in the RAM Status Reports dated 16 November 2001, 22 May 2002 and 20 November 2002).

Six soil samples were collected within the bioremediation area in December 2001 and March 2002 and analyzed for EPH carbon range C11-C22 aromatics and target analytes. Results of the soil sampling indicate that bioremediation has occurred and that the remedial goal has been met. Concentrations of EPH in the soil had been reduced to below the applicable UCLs. Therefore, the BioBox was shut down on 25 March 2002 and was disconnected from the water holding tank and the injection well system.

The MCP (310 CMR 40.0046) requires collection of groundwater samples hydraulically upgradient, downgradient, and underlying the point of application and analysis for the remedial additives every three months following application. Groundwater samples were collected from monitoring wells B601-OW (upgradient), B707-OW (downgradient), and B2001-3 (OW) (underlying) on 10 January 2002 and 11 April 2002. Low-flow sampling technique was used to collect groundwater samples. Samples were sent to Alpha Analytical for analysis of EPH plus naphthalene, ammonia, nitrate, phosphorus, and heterotrophic plant count.

Groundwater analytical results indicated that EPH concentrations in groundwater underlying the remediation area were below Method 1 GW-3 Standards. Sampling results indicated that the concentrations of EPH carbon range C11-C22 aromatics and naphthalene in the downgradient well B707-OW decreased in groundwater samples collected following the remedial alternative injections and were not detected in the last sampling round conducted during April 2002. EPH carbon range C11-C22 aromatics was detected in the groundwater sample collected from upgradient well B601-OW during the sampling round conducted in January 2002. The concentration decreased to non-detect in the April 2002 groundwater sampling round. Based on the groundwater sampling results, it is unlikely that groundwater quality downgradient from the remediation area will adversely impacted.

Additional groundwater sampling was attempted in the summer/fall of 2002 to obtain a complete year of groundwater data in accordance with the MCP to monitor the potential for migration of remedial additives. However, groundwater levels in the vicinity of these two monitoring wells decreased significantly during that time and it was not possible to collect groundwater samples from these wells which would be considered to be representative. A

RAM Status Report was submitted to DEP on 20 November 2002 which explained the inability to sample groundwater and a schedule to sample groundwater in the following six month period if groundwater levels permitted.

Groundwater samples from the B707-OW (downgradient) and B2001-3 (OW) (underlying) were collected on 10 January 2003. Samples were submitted to Alpha Analytical for analysis of EPH plus naphthalene, ammonia, nitrate, phosphorus, and heterotrophic plant count. Results of this sampling round indicated that the concentrations of EPH in the groundwater were below Method 1 GW-3 Standards and the nutrient concentrations resulting from the Bioremediation were decreasing in underlying groundwater. A Bioremediation RAM Completion report was submitted to the DEP on 21 April 2003.

Hazardous Material Management Plan (Items 12 and 13)

In 1988, a Hazardous Material Management Plan outlining procedures for soil management and dewatering (items 12 and 13) during construction was prepared by Haley & Aldrich when Building 29 was renovated and One Alewife Center was constructed.

Lehigh Metals and Babo's Restaurant

In 1987 Grace purchased the 2-acre property located between Jerry's Pond and the Alewife Brook Parkway (Lehigh/Babo's Parcel). The Lehigh Metals and Babo's Restaurant parcel was assigned DEQE Site Number 3-3411 as a result of a report prepared for the Site, under the Massachusetts General Laws (MGL) Chapter 21E, in conjunction with the Grace's purchase of the Site in 1987. This report was submitted to the DEP in 1987.

Two buildings were located on this property, the Lehigh Metals building and the Big Burger Drive-In, both built in 1956. Lehigh Metals occupied the majority of their building from 1956 through 1985, and used the space primarily as warehouse space for storage of metal fasteners and hardware products. At times, other companies had occupied the Lehigh Metals building, primarily from the mid-1960s until building demolition in the late 1980s, including the Cambridge Machine Company, United Research, Inc., deHartt, Inc. (electronic research), and Micro Tek Electronics. The Big Burger Drive-In was converted to a Kelly's Restaurant in the 1960s and Babo's Restaurant at a later date. These buildings were subsequently razed later in 1988.

The Lehigh/Babo's parcel Site was transitioned into the 1993 MCP as a site requiring No Further Action using a Consultant of Record Statement. This property is currently not considered a part of the Grace Site.

1.4.3 Current Regulatory Status under the MCP

Tier Classification - Tier 1C Permit

The redesign of the MCP in 1993 allowed for the transitioning of disposal sites listed in the "old" system to the "new" system within a timeframe set forth in the regulations. The Grace Site was listed as a Confirmed, Non-Priority Disposal Site without a Waiver, according to the 1993 Transition List of "Confirmed Disposal Sites and Locations to be Investigated." In compliance with the Transitions Provisions of the MCP, Haley & Aldrich submitted a Tier II Classification for the Grace property on 4 August 1995.

The DEP issued a Notice of Audit on 26 January 1996 informing Grace the Tier II submittal was to undergo auditing by the DEP, and then based on the audit findings, issued a Notice of Audit Findings/Notice of Non-Compliance to Grace dated 20 September 1996. According to the Notice of Audit Findings, additional points were added to the Grace Numerical Ranking System (NRS) Potential Exposure Pathway score by the DEP because of the potential for odiferous emissions of naphthalene during remediation and redevelopment activities proposed for the Site.

The reevaluation of the Site in response to the Notice of Non-Compliance resulted in the submission of a new tier classification in October 1996, recommending the Site be reclassified as Tier IC under the MCP. The Site was granted a Tier IC permit the following year, with an effective date of 13 February 1997. The Tier IC permit allowed for continuing oversight of the Site by a Licensed Site Professional, however, certain activities on the Site could require the approval of the DEP. The Tier IC permit is effective for 5 years and therefore expired on 13 February 2002. A permit extension application was submitted to the DEP on 16 November 2001. A permit extension was issued for the Site by the DEP on 25 February 2002 extending the permit through March of 2004. A second permit extension application was recently submitted to the DEP on 19 December 2003. DEP is in the process of reviewing this application.

Release Notification for Asbestos

Two field programs were completed at the Site in 1998 to investigate for the presence of asbestos in soil (described in detail in Section 2, entitled "Initial Activities for Asbestos (1998-2000)"). The field programs were completed in response to concerns raised by community members about the potential presence of asbestos at the Site and potential exposures to such material in the event the Site was redeveloped. In response to these concerns Grace voluntarily undertook a sampling program to characterize soil at the Site for the presence of asbestos. Based on the findings of these investigations, a second RTN (RTN 3-17014) was assigned to the Site in June 1998. In July 1999, RTN 3-17014 was closed by the DEP and the compliance obligations for this RTN were incorporated into existing compliance obligations under RTN 3-0277.

In a memorandum prepared by DEP dated 31 July 2000, DEP indicated the 1988 risk characterization was not adequate for the Site, given the recent detection of asbestos in soil at the site. DEP further indicated that data for the Site (asbestos and new data for other

contaminants) generated since the completion of the 1988 risk assessment and Phase II CSA (i.e. 1998 report entitled "Environmental Data Report") needed to be incorporated into risk calculations for the Site.

Therefore, on behalf of Grace, Haley & Aldrich has prepared this Phase II CSA for the presence of asbestos. Results of the Phase II characterization for asbestos and the evaluation of risk due to the presence of asbestos at the Site are presented in the following sections of this document. The Phase II CSA and risk characterization evaluate only asbestos. It is understood that a re-evaluation of total site risk, considering new data for other contaminants at the Site is still required and it is our intention to address this as a part of a Response Action Outcome (RAO) report, at the appropriate time.

1.4.4 Other Activities Completed at the Site (i.e. activities not required under the MCP, but required due to detection of asbestos in Soil)

In addition to the Site characterization activities conducted to satisfy the requirements of the MCP, Grace has also conducted two (2) Release Abatement Measures (RAMs) for the excavation of two utility trenches and installation of electrical utility conduits and associated transformers at the Site.

The two separate RAM activities were conducted in 2001 and 2002, in accordance with the following reports:

- "Final Utility Trench Excavation Release Abatement Measure (RAM) Plan/Asbestos Soil Management Plan (ASMP)" dated 3 May 2001.
- "Final Addendum to Utility Trench Excavation Release Abatement Measure (RAM) Plan/Asbestos Soil Management Plan" dated 13 September 2001.
- "Utility Trench Excavation Release Abatement Measure (RAM) Plan/Asbestos Soil Management Plan (ASMP)" dated 11 November 2002.

The objective of both Utility Trench Excavation Release Abatement Measure (RAM) /Asbestos Soil Management Plans (ASMP) was to provide management procedures and methods by which excavation of a utility trench could be completed at the Grace Site, in accordance with the COC Asbestos Protection Ordinance. The COC Public Health Department required that the soil "disturbing activity" at the Site be conducted either in a layer of clean fill or under a "temporary structure maintained at a partial vacuum . . . with off gas from the evacuation system treated with HEPA filtration."

Excavation of the utility trench and the management of exposed soil (i.e., the soil disturbing activity) were conducted within a temporary, self-supported structure. A negative pressure condition was maintained within the structure using a ventilation system, which was also equipped with a HEPA filter. Maxymillian Technologies Inc. and Haley & Aldrich, Inc. conducted the Utility Trench RAM activities on the Grace property in October and November 2001 (Trench RAM No. 1) and November and December 2002 (Trench RAM No. 2).

Excavated materials were sprayed with water and kept wet during excavation. Excavated soil was also monitored during excavation for visual and olfactory evidence of contamination. Excavated soil was removed from the Site and transported for disposal as a Special Waste at Waste Management's Turnkey Facility in Rochester, NH. There were no exposures of the workers or the public to asbestos fibers. With one exception, based on the monitoring data collected during the conduct of the work, no asbestos fibers were detected in the air during soil disturbing activities. The following reports were submitted to the DEP upon completion of the Utility Trench RAM activities:

- "Utility Trench Excavation Release Abatement Measure (RAM) Completion Report" dated 4 January 2002.
- "Utility Trench Excavation Release Abatement Measure (RAM) Completion Report" dated 3 February 2003.

2. SITE HYDROGEOLOGICAL CHARACTERISTICS

2.1 Site Geologic Conditions

The Site is underlain by four primary soil types. From the ground surface down, the soil types are fill, peat, medium to fine sand, and silty bedrock below the silty marine clay. Both the fill and peat layers are only present in certain areas of the Site. In some locations, the subsurface conditions are simply sand and clay over bedrock. In other locations, till has been encountered beneath the silty marine clay, overlying the bedrock. The general stratigraphy of the Site is as follows:

Stratum Description	Thickness of Stratum
Fill: Very loose to very dense brown to black gravelly medium to fine sand, with varying amounts of brick, boulders, rebar, concrete, metal scraps, cinders, and asphalt.	1.0 to 10 ft thick
Peat: Very loose to loose brown to black fibrous peat with varying amounts of medium to fine sand and silt.	0.0 to 7.0 ft thick
Sand: Medium dense to dense gray medium to fine sand or gray fine sand with varying amounts of silt.	12.0 to 38.5 ft thick
Clay: Very soft to medium stiff gray silty clay.	up to 137 ft thick

The majority of the borings completed for the initial investigation conducted to evaluate the presence of asbestos in soil at the Site were completed to a depth of 4 ft bgs.

2.2 Site Groundwater Conditions

Investigations completed by Haley & Aldrich and others, in the 1970s and 1980s, included the installation of multi-level groundwater sampling devices set in various strata underlying the Site. Piezometric levels observed in these sampling devices indicate a general vertical hydraulic gradient in addition to a horizontal hydraulic gradient. Although indicator tests have shown vertical groundwater movement, the majority of groundwater movement occurs in the upper half of the sand unit, due to the rapid decreasing permeability with depth of the sand unit.

Prior to construction of the MBTA tunnel, near surface groundwater flowed north-northwest across the Site to Alewife Brook at a calculated rate of approximately 22 feet per year. Prior to tunnel construction, Parkway Pond collected surface water runoff from the immediately surrounding area and carried it to Yates Pond, which discharged to Alewife Brook. With the installation of the MBTA tunnel, the groundwater flow pattern beneath the Site was altered. During tunnel construction, dewatering activities implemented to control the groundwater level diverted groundwater flow toward the location of the tunnel excavation. Since completion of the tunnel, groundwater measurements indicate a groundwater depression exists in the vicinity of the tunnel south of well B207-OW, due to leaks in the tunnel walls.

Groundwater studies completed at Russell Field by the COC in 1998 also indicate that groundwater is moving from the Clifton Street neighborhood towards Jerry Pond and the Red Line tunnel. Groundwater levels at Russell Field wells immediately in the vicinity of the tunnel also exhibited a depression indicating a possible water leak into the tunnel. Environmental Health & Engineering, Inc. presented the results of the Russell Field groundwater study in a reported dated 22 October 1998.

Construction of the MBTA tunnel resulted in a groundwater divide in the northern portion of the Site. Generally, groundwater on the north and northwest side of the divide flows south/southwest toward Alewife Brook. Groundwater to the south and southeast of the divide flows in a northwesterly direction toward the tunnel. The reversal of flow is caused by the leak in the MBTA tunnel, which acts as a groundwater discharge boundary and creates a depression in the vicinity of the leak.

Since the 1988 Environmental Data Report, Haley & Aldrich has conducted 13 groundwater gauging and monitoring events at the Site. Groundwater contour plans of groundwater level data collected from those programs support the conclusions of the 1988 report regarding groundwater flow direction. Groundwater level measurements recorded during these investigations indicate groundwater is present at the Site at depths of approximately 4.0 to 11.0 ft bgs.

Jerry's Pond has no hydraulic inlet or outlet. Based on data collected on the Site, groundwater appears to flow into Jerry's Pond from the easterly and southerly direction. Groundwater flowing from the northern and western sides of Jerry's Pond and the retention pond connected to and located north of Jerry's Pond recharge the groundwater system that flows into the MBTA tunnel.

2.3 Potential for Flooding

Portions of the Grace property lie within the limits of the 100-year floodplain. Figure 2 depicts the limits of the 100-year flood elevation. Also as shown on Figure 2, several wetlands are located on and/or surrounding the Site.

3. CHARACTERIZATION FOR ASBESTOS FIBERS

3.1 Asbestos Characterization Test Methods

Methods for measurement of asbestos fibers in soil, groundwater, and/or air involve a combination of techniques for sample preparation, asbestos fiber identification, and quantification of asbestos fibers using optical and/or electron microscopes. The methods used depend on initial sample preparation, including separation of asbestos from matrix material where that is feasible. Determination and quantification of the presence of asbestos in soil is especially difficult, as there is no method available that can adequately separate asbestos fibers from soil mineral particles.

The following sections present a brief summary of the soil, groundwater and air sample preparation and analytical techniques used for the analyses conducted as a part of this Phase II CSA.

3.1.1 Analytical Methods for Asbestos in Soil

Polarized Light Microscopy (PLM)

Polarized Light Microscopy (PLM) is the principle optical technique used for the identification of asbestos fibers. Using polarized light, and immersing the fibers in various liquids with different refractive indexes, various optical properties of the fibers can be measured in a sample applied to a microscope slide. These properties may be used to distinguish asbestos fibers from non-asbestiform fibers. Fibers which are thinner than the resolving power of the microscope, around 0.3 μm in diameter, will not be detected.

There are several methodologies for using PLM to qualitatively and quantitatively evaluate for the presence of asbestos in various media. Soil and sediment samples collected by Haley & Aldrich for PLM analysis were analyzed in accordance with EPA Method 600/R-93-116 Polarized Light Microscopy, July 1993, as described further below. This is the method originally used by EPA to characterize asbestos in bulk building materials.

Transmission Electron Microscopy (TEM)

Transmission electron microscopy directs a beam of electrons at the specially prepared sample (usually coated with a very thin layer of carbon or gold), and examines how the electrons coming out the other side, or re-emitted from the sample, have interacted with the sample. The area of the sample examined tends to be extremely small (the magnification is very large), and TEM can be used to identify the narrowest fibers (well below the limit detectable in an optical microscope), and also to identify very small quantities of fibers (if they can be found). Diffraction patterns observed in the electrons that pass through the sample show the crystal structure of the area of the sample through which the beam passed (the technique is known as selected area electron diffraction or SAED).

Examination of the spectrum of energies of electrons re-emitted from the sample under

electron beam bombardment (a technique called energy dispersive x-ray analysis or EDX) allows identification of the elemental composition of the sample. However, there are possible interferences — other amphibole particles with aspect ratios greater than 3:1 and elemental compositions similar to asbestos minerals may give similar results, while non-asbestos minerals (including other amphiboles) may give similar diffraction patterns, and background dust can interfere with fiber identification.

As with PLM there are several methodologies for using TEM to qualitatively and quantitatively evaluate for the presence of asbestos. Samples collected by Haley & Aldrich were prepared and analyzed by Scientific Laboratories Inc. (SciLab) in accordance with the National Voluntary Laboratory Accreditation Program's Chatfield Method for determining asbestos content using TEM (EPA 600/R-93-116-Chatfield Semi-Quantitative). The Chatfield Method is a modified version of EPA Method 600/R-93-116 (the EPA Bulk Materials analysis method) using a semi-quantitative procedure.

Sample preparation for TEM analysis isolates suspect asbestos fibers from the original soil sample in an unrepresentative sub-sample. The fibers are placed on a slide and covered with material that keeps the fibers from becoming air borne. Grid openings on the slide, usually four, are viewed through a transmission electron microscope. The presence of asbestos fibers is determined through analysis of the chemical components of the fiber and the fiber's size ratio. If the fiber positioned beneath the grid opening is asbestos, the percentage of area occupied by the asbestos fiber within the grid opening is calculated. The percentages of area covered by asbestos beneath each of the four grid openings on the slide are averaged together, giving the resulting percentage of asbestos present as determined by the TEM methodology.

<u>EPA Region 1 Protocol (December 1997)</u>

The "Protocol for Determining Asbestos Content in River Sediments and Soil Samples" (the Protocol) was developed by US EPA Region 1 "out of necessity to facilitate finding asbestos fibers in a soil or mud (sediment) sample that does not contain any obvious asbestos fibers or asbestos-containing building or product materials when examined dry (or wet) using a stereo microscope at 10X or 20X magnification." A portion of the sample is thoroughly rinsed to remove colloidal material, fine sand, silt, and other non-fibrous particulates. A semi-quantitative method is used to estimate the volume fraction of matrix removed by such rinsing. The rinsed sample is then systematically examined under water at 10X to 20X magnification with a stereomicroscope for the presence of asbestos fibers. Samples of suspect fibers are removed and examined for identity using PLM. If asbestos fibers are identified, a visual estimate is made of the fraction of such fibers in the whole portion examined, and this fraction is then adjusted to account for the fraction of the sample washed away. The Protocol was not originally designed to be used quantitatively, although it has been modified to report approximate percentage amounts by volume. It is expected to determine whether or not the soil is contaminated with significant amounts of asbestos (>1% by volume).

Soil samples collected by Haley & Aldrich for PLM analysis were prepared and analyzed in accordance with the Region 1 Protocol, in conjunction with Polarized Light Microscopy (using EPA Method 600/R-93-116).

Comparability of Region I Protocol PLM / TEM

The percentage results of the Protocol in conjunction with PLM method and the TEM method are not directly comparable. An analyst using the Protocol with PLM method determines the amount (reported as a volume percent) of asbestos contained in the entire soil sample, which was the analytical goal of the asbestos sampling programs completed at Grace. The TEM method provides a percentage (reported as a mass percentage), however the percentage is of asbestos present in a non-representative sub-sample viewed through a grid opening on a slide, and it does not reflect the amount of asbestos present in the original soil sample.

The Protocol method attempts to provide a result that is representative of the entire sample, where as the TEM method is providing a result that is representative of a very small fraction of the entire sample and applies that result to the entire sample. Thus, the results of the two methods may not be directly comparable. A mass result and a volume result, under most circumstances are also not directly comparable. However, for the soil matrix EPA has determined that the difference is small (EPA, 1988).

3.1.2 Groundwater/Surface Water Methods

Groundwater and surface water samples collected at the Site were analyzed using the EPA Drinking Water Method 100.1 (EPA 600/4-83-043) "Analytical Method for Determination of Asbestos Fibers in Water." The 100.1 EPA Drinking Water Method counts fibers greater than 0.5 µm in length with an aspect ratio of 3:1. Although not used for the sampling discussed in this Phase II CSA, EPA also has a second drinking water method - Method 100.2 (EPA/600R-94/134). Method 100.2 counts only those fibers greater than 10 µm in length. According to the EPA, Method 100.2 was established due to the fact that health studies have indicated that from an ingestion standpoint, fibers less than 10 m in length are not thought to result in adverse health effects. To be conservative, Method 100.1 was used for the Phase II groundwater and surface water sampling at Grace.

This EPA drinking water method is a TEM method for identification of asbestos (as described above) with a detection limit reported in millions of fibers per liter (MF/L). Depending on the volume of water used during the analysis, the method is able to achieve detection limits of < 0.18 MF/L, which is well below the EPA drinking water standard (7 MF/L).

3.1.3 Air Methods

Phase Contrast Microscopy (PCM)

Phase Contrast Microscopy (PCM) is the standard technique for counting fibers collected on filters during air sampling, and is the technique used for analysis of personal and ambient air samples collected as a part of this Phase II CSA. The technique uses an optical phase contrast microscope. This microscope is able to take advantage of the refraction of light through a non-opaque object, and the diffraction of light around the object, converting differences in the phase of such light from the background illumination into amplitude (brightness) differences that can be viewed or filmed. Using this technique, fibers as small as 0.25 µm diameter (about ½ the wavelength of visible light) can be imaged. The technique is not sensitive to the

type of fiber being examined (i.e. it cannot distinguish between asbestos fibers and non-asbestos fibers).

Air samples collected as a part of this Phase II CSA were analyzed using the NIOSH air sample analysis methods: Method 7400 - "Analysis of asbestos fibers by PCM" and/or Method 7402 - "Analysis of asbestos fibers by TEM".

3.2 Initial Evaluations for Asbestos in Soil

Two separate asbestos sampling programs were conducted at the Grace Site in May and December of 1998. During the December 1998 program, Grace along with two interested parties, the COC and the Alewife Study Group (ASG), collected and analyzed split soil samples.

3.2.1 May 1998 Soil Investigation

In response to concerns raised by community members about the potential presence of asbestos at the Site and potential exposures to such material in the event the Site was redeveloped, Grace voluntarily undertook a sampling plan to characterize soil at the Site for the presence of asbestos. The sampling plan developed by Grace was reviewed and agreed upon by the DEP, the COC, and the Alewife Study Group (ASG). Explorations began on 14 May 1998.

Fourteen GeoProbe borings were completed to a depth of 8 feet below ground surface (bgs), with composite samples collected at two foot intervals for a total of 56 subsurface soil samples (see Figure 4 for sample locations). Eight boring locations were selected by Haley & Aldrich in areas at the Site where historical information indicated asbestos or asbestos products may have been utilized in a research and development laboratory the vicinity of former Buildings 11 and 12 (Figure 3). Six locations were selected by the COC and ASG, three on the western edge of the property and three adjacent to and south of buildings 1, 2 and 3, currently present on the property.

Samples were submitted to Scientific Laboratories, Inc. (SciLab) of Midlothian, Virginia for analysis using the Region 1 Protocol, in conjunction with Polarized Light Microscopy (EPA Method 600/R-93-116). Asbestos content in the soil samples was reported as either "No Visible Asbestos", "Trace" (less than one percent asbestos fibers detected in the sample), or as an estimated percentage of asbestos present in the sample, to the nearest whole number, beginning at one percent. The results of the PLM analysis completed as part of the May 1998 investigation are included in Table I and summarized in Section 4 of this report.

The results of this analysis were reported in "Asbestos Soil Sampling Program Results, 62 Whittemore Avenue, Cambridge, Massachusetts," dated 17 June 1998 prepared by Haley & Aldrich.

3.2.2 December 1998 Soil Investigation

Based on the findings in the Asbestos Soil Sampling Program report dated July 1998, a site-wide soil sampling program was developed with input from the DEP, the COC and the ASG, and presented in a document entitled "Final Asbestos Sampling Plan, W.R. Grace & Co.-Conn., Cambridge Massachusetts," dated 18 November 1998 prepared by Haley & Aldrich, Inc. The Site was divided into Zones (1 through 5) based on historic property use. An approximate 35-foot interval grid was employed across the majority of the sampling area in zones where the primary soil cover is vegetation (Zones 2 and 4). See Figure 4 for sample locations. A 50-foot interval grid was used in Zone 1, which comprises the paved or building-covered portion of the Site, and Zone 3, which is covered with vegetation but has not been occupied by buildings in the past.

Although not considered a part of the disposal site, Grace included the Lehigh/Babo's parcel in the December 1998 asbestos sampling program because it was a part of the area proposed for redevelopment. Lehigh/Babo's was designated as Zone 5 in the sample program. Boring locations in Zone 5 (Lehigh / Babo's Parcel) were placed on the northern half of the parcel, within and around the former foundation of the Lehigh Metals building.

Subsurface and/or surficial soil samples were collected from 313 GeoProbe boring locations (often multiple samples were collected from the same boring) and additional surficial samples were collected by hand from 38 locations. Surficial soil samples were collected from the 0-0.5 ft depth interval, and subsurface samples were collected from 0.5-4 ft bgs interval. Twenty-four (24) samples were also collected and submitted for analysis by Grace in December 1998 at the 0 to 4, 4 to 8 ft, and 8 to 12 ft depth intervals. Haley & Aldrich visually inspected soil samples for the presence of potential asbestos containing material. Material identified as possible Transite (historically a common building material, which is typically comprised of silicate minerals and the chrysotile form of asbestos) was observed in the subsurface samples collected from two locations, AB2-77 and AB2-81. A discreet sample of this material was collected, but not analyzed.

Samples were submitted to SciLab for analysis in accordance with Region 1 Protocol, in conjunction with PLM (using EPA Method 600/R-93-116). SciLab also analyzed thirty duplicate soil samples randomly selected from the 589 samples collected by W.R. Grace using TEM (EPA 600/R-93-116-Chatfield Semi-Quantitative). Results of the December 1998 PLM and TEM analysis sampling are presented in Table III and Table IV and summarized in Section 4 of this report.

The ASG and the COC retained environmental consultants, GeoInsight, Inc. and EnviroSense, Inc., respectively, to collect split soil samples during the field component of the asbestos sampling program in December 1998. Prior to the start of the field work, both groups agreed to request that their laboratories use the same method being used by Grace to analyze the split soil samples for asbestos content by (PLM). A comparison of analytical results of split samples collected by W.R. Grace, the COC and the ASG and analyzed using PLM is included in Table V. Twelve split soil samples were sent to Lab/Cor, Inc. in Seattle, Washington and analyzed by TEM using EPA Method 600/R-93/116. Table VI presents a comparison of the

3.5.2 High Volume Air Monitoring

Levine Fricke Recon (LFR) conducted ambient air monitoring at locations around the property using high-volume air sampling techniques in July 1998. A total of 20 air samples collected by LFR at 30 separate locations were prepared in accordance with the AHERA protocol and analyzed using PCM for the presence of fibers. The PCM analytical results were compared to the AHERA "indoor air" criteria of 0.01 f/cc. If PCM results indicated a concentration greater than the 0.01 f/cc criteria, the sample was then prepared in accordance with the AHERA protocol and analyzed using TEM in accordance with NIOSH Method 7402.

In December 1998, LFR also conducted background air sampling during the December 1998 soil sampling program. Ten air samples were collected at locations around the property and analyzed using TEM for the presence of asbestos fibers, in accordance with NIOSH Method 7402.

In October 1999, background ambient air samples were again collected and analyzed using TEM, in accordance with NIOSH Method 7402. (See Section 4.2 for results.)

3.6 Evaluation for Asbestos in Surface Water

Four surface water samples were collected on 21 October 1999 using a stainless steel remote sampler and standard surface water sample collection techniques from locations along the northern bank of Jerry's Pond on 21 October 1999 (see Figure 8 for sampling locations). The samples were placed in coolers, preserved with ice packs, and sent to Scilab in Virginia. SciLab analyzed the samples using the EPA Drinking Water Method (EPA-600/4-83-043 (100.1)). (See Section 4.3 for results.)

3.7 Evaluations for Asbestos in Groundwater

Groundwater samples were collected from three wells and analyzed for asbestos content during five groundwater sampling events conducted from October 1999 through May 2000. Three groundwater monitoring wells were selected due to their proximity to the MBTA tunnel, specifically, in the vicinity of the groundwater leak into the tunnel. The locations of the wells selected (B207-OW, B807-OW, and B503-OW) are shown on Figure 8. Results of the groundwater sampling are presented in Section 4.4.

3.7.1 October 1999 Sampling

During the first sampling round in October 1999, groundwater samples were collected from the three wells (B207-OW, B807-OW, and B503-OW) using standard well sampling techniques with Waterra tubing. At least three well volumes were purged from each well prior to sampling. The samples were placed in coolers, preserved with ice packs, and sent to Scientific Laboratories in Midlothian, Virginia. The laboratory analyzed the samples using the EPA Drinking Water Method (EPA-600/4-83-043 (100.1)) described in Section 4.4. The results of this first sampling indicated the laboratory was only able to achieve a detection limit of 21 MF/L. This detection limit was not acceptable and was due to the fact too small a volume of water (0.0001 L) was filtered through the TEM filter. In order to achieve a lower

method detection limit, the laboratory needed to filter a greater amount of water (at least 0.01 L) from the sample through the TEM filter. Thus subsequent rounds of sampling were conducted.

3.7.2 November 1999 Sampling

On 17 November 1999, the same three wells were sampled again using the same collection and sampling techniques. The laboratory was instructed to use the same analytical method with adequate sample volume (at least 0.01 L) to achieve a detection limit of 0.18 MF/L. According to the laboratory, two of the three samples submitted in November (B207-OW and B503-OW) had to be analyzed using a lower detection limit because the samples contained elevated levels of particulate matter, identified as iron oxide, which resulted in interference during the TEM analysis step.

3.7.3 December 1999, February 2000 and May 2000 Sampling

In December 1999 and February 2000, and May 2000 Haley & Aldrich used low-flow sampling techniques to collect three additional sets of groundwater samples from wells B207-OW, B807-OW (Dec and Feb only) and B503-OW (Dec and Feb only). The low-flow technique was used in order to reduce levels of iron oxide in the samples. A Grundfos pump was used to regulate flow and reduce the rate of flow to the lowest effective rate. At least three well volumes of water were purged from the wells prior to sampling. For the May sampling round, approximately 25 times the standing well volume, or 55 gallons of water, were purged from the well prior to sampling. A larger volume of water was purged in order to reduce the turbidity of the water, reduce the particulate matter in the sample, and also reduce the iron oxide content in the sample. The samples were placed in coolers, preserved with ice packs, and sent to Scientific Laboratories. All samples were analyzed using the EPA Drinking Water Method (100.1) with the lower detection limit.

In December, the laboratory was again unable to analyze two of the three samples collected (B207-OW and B503-OW) due to excess iron oxide, in the groundwater samples. For the February 2000 and May 2000 sampling rounds, Haley & Aldrich instructed the laboratory to prepare the samples using a hydrochloric acid dissolution step to reduce the iron oxide content of the samples. The laboratory ran a test sample using the acid wash and confirmed that the use of hydrochloric acid to the wash the sample and dissolve the iron oxide would not break down asbestos fibers potentially present in the sample. This step proved effective in removing the iron oxide and the samples were successfully analyzed using the EPA Drinking Water Method (100.1) with the lower detection limit.

3.8 Evaluation for Asbestos in Sediment

Ten sediment samples were collected from locations on the north, east and west banks of Jerry's Pond, as shown on Figure 8. Sediment was collected using a trowel and placed into stainless steel bowls. The sediment contained elevated moisture levels and did not require additional wetting. The collected sediment was homogenized using the trowel, and a sample was collected from the bowl. The samples were preserved with ice packs and sent to Scientific Laboratories in Midlothian, Virginia, and prepared and analyzed in accordance with the EPA Region 1 Protocol and using PLM. (See Section 4.5 for results of sediment sampling).

3.9 Additional Characterization of Asbestos in Soil

In September 2003, a targeted soil sampling program was conducted. Five areas were targeted for additional sampling based on the results of the 1998 sampling programs which indicated elevated levels of asbestos were detected in the soil in these areas. Locations AB-3 and AB-8 from the May 1998 sampling and locations AB2-4, AB2-15, and AB2-38 from the December 1998 sampling program were targeted for additional sampling. The 20 sampling locations for this additional characterization are depicted on Figure 4.

On 18 September 2003, a total of 20 geoprobe borings (4 borings around each of the previous five locations described above) were completed at the Site by Geologic, Inc. Each borings was located approximately six (6) inches to one (1) foot from the original location, at 90 degree intervals. The borings were completed to a depth of five (5) feet below ground surface and five composite samples of the fill soil were collected from each boring from 0.5 to 5 ft, below the asphalt, topsoil, and/or pavement sub-base materials. Natural soils were not encountered at depths shallower than five 5 ft in the borings.

Soil samples were visually inspected for potential asbestos containing material such as building material with mastic or insulating material. Suspect materials were not observed in the soil collected during this boring program.

At each of the 20 boring locations, five (5) composite samples were collected and submitted to SciLab MA for asbestos analysis following methods outlined in EPA Region I Protocol for Screening Soil and Sediment Samples for Asbestos Content, latest revision dated 5 December 1997. The presence of asbestos in the samples was determined using EPA Method 600/R-93-116 (PLM).

The results of the 2003 soil sampling program are summarized in Table VII and discussed in detail in Section 4.

4. NATURE AND EXTENT OF CONTAMINATION

4.1 Soil

As described in the previous section, three explorations programs were conducted at the Site, in May 1998, in December 1998, and September 2003 (Figure 4). During the December 1998 sampling event, both the COC and the Alewife Study Group (ASG) collected split samples. Samples submitted by Grace for PLM analysis were analyzed by SciLab, on behalf of Grace, in accordance with the Region 1 Protocol, in conjunction with Polarized Light Microscopy (using EPA Method 600/R-93-116). Prior to the start of the field work, both ASG and the COC agreed to request that their laboratories use the same method being used by Grace to analyze the split soil samples for asbestos content by PLM.

A total of 882 soil and split soil samples collected by various parties from the Grace Site have been analyzed for asbestos content by PLM and/or TEM. The following Table (4.1) summarizes the sample collection and analysis:

Table 4.1

Sampling Event	Total No. Samples PLM	Total No. Samples TEM
H&A May 1998	**56**	**7**
Subsurface	56	7
H&A DEC 1998	**589**	**30**
Surface	266	14
Subsurface	323	16
ASG DEC 1998	**55 ****	**12**
Surface	0	4
Subsurface	55	8
COC DEC 1998	**33**	**0**
Surface	10	0
Subsurface	23	0
H&A SEPT 2003	**100**	**0**
Subsurface	100	0
TOTALS	**833**	**49**
Surface	276	18
Subsurface	557	31

** EPA Protocol may not have been followed correctly during sample analysis for ASG. See Section 4.1.5.

Results of the various analyses are summarized in Tables I through VI attached to this report.

4.1.1 PLM Results 1998

Table I presents Grace PLM analytical results from May 1998 and Table III from December 1998. Table V presents the PLM data for the COC and the ASG, as compared with the results for samples analyzed by Grace. Figure 5 depicts the Grace PLM sampling locations and results. Figure 6 depicts the City and the ASG PLM sampling locations and results. A summary of each of these results is presented below in Table 4.1.1.

Table 4.1.1

PLM Results	Total #	No Visible Asbestos	TRACE (<1%)	> 1%
H&A May 1998	56	31	14	11
H&A DEC 1998	589	555	8	26
ASG SPLIT SAMPLE DEC 1998	55 **	41	0	14
COC SPLIT SAMPLE DEC 1998	33	30	1	2
TOTALS	733	657	23	53

** EPA Protocol may not have been followed correctly during sample analysis for ASG. See Section 4.1.5.

Of the 56 samples collected by Haley & Aldrich for analysis as a part of the May 1998 program, 31 samples contained No Visible Asbestos, 14 samples contained Trace levels of asbestos, and 11 samples contained percent levels of asbestos, ranging from 2 to 12%. Of the total of 589 samples collected by Haley & Aldrich in December 1998, 555 of the samples analyzed by W.R. Grace were determined to contain No Visible Asbestos using the Protocol with PLM. Trace levels of asbestos were detected in 8 samples. In 26 samples, asbestos was detected at percent levels, ranging from 1 to 7%.

In total, 733 samples were submitted by the COC (33), Grace (645) and ASG (55) for PLM analysis. Because each party was splitting samples, three samples were often collected and analyzed (one by each interested party) from one sampling location. Of these 733 samples, 657 samples contained no visible asbestos material, 23 samples contained asbestos at "trace" levels (less than 1%), 53 samples were determined to contain asbestos at 1% or greater. Therefore, 89.6% of the soil samples analyzed using PLM in 1998 contained no visible asbestos material.

Grace analytical results from May 1998 investigation indicate chrysotile and amosite were detected at the Site using PLM. Grace analytical results of the December 1998 investigation indicate chrysotile and crocidolite were detected at the Site using PLM.

4.1.2 PLM Results 2003

Table VII presents the Grace PLM analytical results from September 2003 and a summary of each of these results is presented below in Table 4.1.2. Figure 5 also depicts the sampling locations and presents the results.

Table 4.1.2

PLM Results	Total #	No Visible Asbestos	TRACE (<1%)	> 1%
H&A SEPT 2003 TOTALS	**100**	**21**	**61**	**18**

Of the 100 samples collected by Haley & Aldrich for analysis as a part of the September 2003 program, 21 samples contained No Visible Asbestos, 61 samples contained Trace levels of asbestos, and 18 samples contained percent levels of asbestos, ranging from 1 to 4%. The samples in which 1 to 4% asbestos fibers were detected by PLM were samples collected from the additional borings completed in the areas around AB-3 and AB-8 (May 1998), and AB2-4

(December 1998). These results are consistent with the previous May and December 1998 sampling rounds conducted by Haley & Aldrich. Results of the sampling for the additional borings completed around Borings AB2-15 and AB2-38 (December 1998) indicated samples contained either No Visible Asbestos or Trace levels. The results differ from the December 1998 results, which could be due to the heterogeneous nature of soil and asbestos in soil.

In total, 833 samples were submitted by the COC (33), Grace (745) and ASG (55) for PLM analysis. Because each party was splitting samples in December 1998, three samples were often collected and analyzed (one by each interested party) from one sampling location. Of these 833 samples, 678 samples contained no visible asbestos material, 84 samples contained asbestos at "trace" levels (less than 1%), 71 samples were determined to contain asbestos at 1% or greater. Therefore, 81% of the total soil samples analyzed using PLM contained no visible asbestos material. Figure 7 depicts the locations in which asbestos fibers were detected at 1% or greater by one or all of the interested parties.

Grace analytical results from May 1998, December 1998 and September 2003 investigation indicate chrysotile was detected at the Site using PLM. In addition, amosite was detected at the Site using PLM with samples collected in May 1998 (in 13 samples) and September of 2003 (in 5 samples) and crocidolite was detected in one sample from December 1998

4.1.3 TEM Results

Table II and IV present Grace TEM analytical results from May and December 1998, Table VI presents ASG TEM analytical results. The COC did not submit samples for TEM analysis. A summary of the results is provided below in Table 4.1.3.

Table 4.1.3

TEM Results	TOTAL #	ND	TRACE (<1%)	> 1%	TYPE (# of samples)
H&A May 1998	7	1	2	4	Chrysotile (6)
H&A DEC 1998	30	23	5	2	Chrysotile (7)
ASG DEC 1998	12	7	5	0	Chrysotile (1), Actinolite (2) Chrys-Actinolite (1) Chrys-Act-Tremolite (1)
TOTALS	49	31	12	6	

Of the 49 samples analyzed by TEM, 31 samples contained no asbestos material, 12 samples contained "trace" levels of asbestos, and 6 samples were determined to contain 1% or greater asbestos. Therefore, 63.3% of the soil samples analyzed using TEM contained no visible asbestos.

4.1.4 Surficial Soil

Surficial samples were collected in December 1998 from the 0 to 0.5 depth interval. These samples are designated "S1" in Tables III and IV. In total, 276 surficial samples were analyzed by Grace and COC using PLM and 18 samples using TEM. In May 1998 Grace did not collect surficial samples (0 - 0.5 ft). In December 1998, ASG did not submit surficial

samples for analysis using PLM. Table 4.1.4 below summarizes the surficial sample results for both PLM and TEM analysis.

Table 4.1.4

Surface Soil Results	TOTAL #	NVA / ND	Trace (<1%)	> 1%
H&A DEC 1998				
Surface - PLM	**266**	258	3	5
Surface - TEM	**14**	11	2	1
ASG DEC 1998				
Surface - PLM	**0**	0	0	0
Surface - TEM	**4**	2	2	0
COC DEC 1998				
Surface - PLM	**10**	10	0	0
Surface - TEM	**0**	0	0	0
TOTALS				
Surface - PLM	**276**	**268**	**3**	**5**
Surface - TEM	**18**	**13**	**4**	**1**

Of the 276 surficial samples analyzed using the Protocol and PLM, 268 samples contained no visible asbestos material, 3 samples contained asbestos at "trace" levels (less than 1%), and 5 samples were determined to contain asbestos at 1% or greater. Therefore, 97.1% of the surficial soil samples analyzed using PLM contained no visible asbestos.

TEM analysis was conducted by Grace and ASG on 18 of the surficial samples. COC did not submit surficial samples for analysis using TEM. Of the 18 samples analyzed by TEM, 13 samples contained no asbestos material, 4 samples contained "trace" levels of asbestos, and 1 sample was determined to contain 1% or greater asbestos. Therefore, 72.2 % of the surficial soil samples analyzed using TEM contained no visible asbestos. The laboratory conducting TEM analysis on the samples submitted by Grace used "Trace" to report results as less than 1%. The laboratory conducting analysis on the TEM samples submitted by ASG quantified the result and reported a decimal percent. Refer to Table VI for a summary of ASG TEM results.

4.1.5 Subsurface Soil

Subsurface samples were collected in May 1998 and December 1998 by Grace, the COC and ASG, and September 2003 by Grace. In total, 557 subsurface samples were analyzed using PLM and 30 subsurface samples were analyzed using TEM by Grace, COC, and ASG in December 1998. Table 4.1.5 below summarizes the subsurface sample results for both PLM and TEM analysis.

Table 4.1.5

Subsurface Soil Results	TOTAL #	NVA	Trace (<1%)	> 1%
H&A MAY 1998				
Subsurface - PLM	56	31	14	11
Subsurface - TEM	7	1	2	4
H&A DEC 1998				
Subsurface - PLM	323	297	5	21
Subsurface - TEM	16	12	3	1
ASG DEC 1998				
Subsurface - PLM	55**	41	0	14
Subsurface - TEM	8	6	2	0
COC DEC 1998				
Subsurface - PLM	23	20	1	2
Subsurface - TEM	0	0	0	0
H&A SEPT 2003				
Subsurface - PLM	100	21	61	18
Subsurface - TEM	0	0	0	0
TOTALS				
Subsurface - PLM	557	410	81	66
Subsurface - TEM	31	19	7	5

** EPA Protocol may not have been followed correctly during sample analysis for ASG. See Section 4.1.5.

Of the 557 subsurface samples analyzed using the PLM, 410 samples contained no visible asbestos material, 81 samples contained asbestos at "trace" levels (less than 1%), and 66 samples were determined to contain asbestos at 1% or greater (14 of which were ASG samples). Therefore, 74% of the subsurface soil samples analyzed using PLM contained no visible asbestos.

Of the 31 samples analyzed by TEM, 19 samples contained no asbestos material, 7 samples contained "trace" levels of asbestos, and 5 samples were determined to contain 1% or greater asbestos.

4.1.6 Comparison of Haley & Aldrich, ASG and COC Data

Table V presents a comparison of analytical results for samples analyzed by Grace, the COC, and ASG using PLM. Figure 5 (Grace) and Figure 6 (COC and ASG) also present a visual comparison of the results. Prior to the start of the field work, both groups agreed to request that their laboratories use the same method being used by Grace to analyze the split soil samples for asbestos content using the EPA Region 1 protocol in conjunction with Polarized Light Microscopy (using EPA Method 600/R-93-116). ASG and the COC sent 88 split samples (55-ASG, 33-COC) to Severn Trent Laboratories, Inc. (STL) for analysis. Tables V and VI compare the analytical results obtained by ASG, COC and Grace.

No asbestos was detected in 30 of the 33 samples analyzed by the COC using PLM. One sample contained a Trace level of asbestos, and two soil samples contained percent levels of asbestos (5% and 11%). Lab data sheets were not provided to Haley & Aldrich by EnviroSense, Inc., on behalf of the COC.

The ASG had 55 subsurface samples analyzed using PLM. Asbestos was not detected in 41 of the samples and asbestos levels ranging from 4% to 18% were detected in 14 of the samples. Lab data sheets, provided to Haley & Aldrich by GeoInsight, Inc. on behalf of the ASG, and subsequent conversations between the DEP and STL, indicate point counting was performed by STL on several of the ASG soil samples. Point counting was not an agreed-upon methodology, as outlined in the Region 1 Protocol combined with PLM, and its use and the results reported are not considered representative by Haley & Aldrich. Based on a letter written by a representative of STL to the DEP, Haley & Aldrich also questions if the EPA Protocol was followed correctly during sample analysis. Copies of correspondence regarding split sample analysis of the Grace samples were previously included in the Haley & Aldrich "Evaluation for Asbestos in Soil" report dated 22 April 1999.

Although there is a question as to whether the data reported by the laboratory for the ASG samples is in accordance with the agreed-upon methodology for the project, the ASG data has been included as a part of the data set for the Site. Therefore, data from Grace, ASG, COC, and the EPA has been used in the Risk Characterization (Appendix F).

In May 2000, Haley & Aldrich obtained a set of TEM data from split samples collected and analyzed by the ASG as part of the December 1998 program. Eleven split soil samples were sent to Lab/Cor, Inc. in Seattle, Washington and analyzed by TEM using EPA Method 600/R-93/116. Asbestos was detected in 4 samples at levels ranging from non-detect to 0.45%. Table VI presents a comparison of the TEM data results obtained by ASG and Grace. Duplicates of soil sample AB2-101 S1 were analyzed using TEM by both Grace and the ASG. Asbestos was not detected in the Grace duplicate sample. Asbestos was detected in the ASG duplicate sample at 0.07%. The TEM analytical data sheets provided to Haley & Aldrich by the ASG are included in Appendix B.

Review of PLM data sheets provided by the ASG and the COC for split sample analyses for asbestos conducted as part of the December 1998 program indicate amosite and chrysotile were detected in those samples. Actinolite-tremolite was detected (0.15%) in one sample submitted for TEM analysis by ASG. This was the only detection of actinolite-tremolite out of the 48 samples submitted for asbestos content analysis using TEM.

4.1.7 Summary of EPA Site Soil Evaluation

The US EPA (Region 1) conducted a Preliminary Assessment/ Site Investigation at the Grace property in August and September 2000. Their assessment included a site reconnaissance conducted on 22 August 2000 and a 2-day sampling program completed on 6 and 7 September 2000. EPA collected 39 samples from the Grace property. The samples were collected from a depth of 0 to 3-ft bgs. Additionally, the EPA collected 13 samples from the neighboring One Alewife Center and Russell Field properties. Results of the site inspection and sampling were published in the EPA's February 2001 Report entitled "Removal Program Preliminary Assessment/Site Investigation Report for the W.R. Grace Site."

EPA noted that several fragments of suspect asbestos containing materials (SACM) were identified on the ground surface in four locations, depicted on Figure 6 of this Report. SACM-1 and SACM-2 were observed in the area identified as Zone 4 (west of Russell Field

Park) in the December 1998 sampling program. SACM-3 was observed in Zone 2 (north of Russell Field Park on the easternmost portion of the Site). The fourth SACM was observed in the area known as Zone 5 (Lehigh/Babo's Parcel). EPA collected samples of the suspect materials in three locations (SACM-01 to SACM-03) for analysis. A sample was not collected from the fourth location (Zone 5), as the material was observed to be the same material from the other 3 locations. EPA observed that the material appeared to be non-friable. In fact the EPA indicated the material was difficult to break up into a discrete sample. The three samples of material were submitted for analysis by PLM. Results of the analysis indicated each of the three samples contained 15% asbestos. The type of asbestos in the materials was identified as chrysotile.

Based on the EPA's findings, on 7 November 2003 Environmental Solutions (a licensed asbestos contractor) removed visible pieces of SACM, debris, and trash from the WR Grace property. Six small pieces (1 to 8 inches in size) of suspect ACM were identified by Environmental Solutions in the area near EPA locations SACM-1 and SACM-2 (based on EPA GPS coordinates and map locations). A seventh piece was identified and removed from the Lehigh/Babo's parcel. SACM was not encountered elsewhere on the property. However, to be conservative other debris was picked up and removed from the Site as well. A notification of the removal was provided to the DEP, in accordance with 310 CMR 7.15(1)(b).

EPA submitted 39 soil samples for analysis in accordance with the Region 1 Protocol, in conjunction with Polarized Light Microscopy (using EPA Method 600/R-93-116) and 25 of these split samples were also submitted for analysis by TEM (EPA 600/4-83-043). Results of the PLM analysis and TEM analysis are summarized in Table X and below in Table 4.1.7.

Table 4.1.7

EPA SOIL RESULTS	TOTAL #	NVA / ND	Trace (<1%)	> 1%
EPA PLM	39	29	10	0
EPA TEM	25	1	24	0

Of the 39 samples analyzed by PLM, 29 samples contained no visual asbestos and 10 samples contained asbestos at "trace" levels (less than 1%). No Asbestos was identified in any of the samples at a level of 1% or greater. TEM analysis indicated that Trace levels of asbestos (0.0002 % to 0.02 %) were identified in 24 of the 25 samples. The asbestos was identified as chrysotile.

The EPA requested that ATSDR review the results of the EPA sampling program and to determine whether the asbestos in the surface soils at the Site pose an immediate health threat under current site conditions and usage. ATSDR concluded that "the asbestos levels present in the surface soils on Site do not pose an immediate or long-term public health hazard" and that subsurface asbestos contamination does not pose an immediate health hazard as long as the waste remains buried, and is not brought to the surface." ATSDR's results are published in their "Health Consultation" dated 20 March 2001. Based on ATSDR's findings EPA concluded in March 2001 that they would not undertake any cleanup activities at the Grace Site, or the adjoining properties. A copy of the EPA Report, the ATSDR Report and EPA's final findings are included in Appendix E.

4.2 Air

4.2.1 Perimeter Air Sampling

Ambient background air sampling was completed at the Site in July 1998, December 1998, and October 1999. Results of the high volume ambient air sampling analyses are summarized in Table IX. Air sampling reports prepared by LFR (who conducted the sampling) are included in Appendix C of this report, entitled "Asbestos Air Sampling Reports."

OSHA, NIOSH and AHERA regulations for asbestos in air use fibers greater than 5 μm in length, with an aspect ratio greater than or equal to 3:1, in determining asbestos concentrations.

In July 1998, LFR conducted ambient background air monitoring at 20 separate locations. The samples were analyzed using PCM for the presence of fibers. The PCM results ranged from total fiber concentrations less than (<) 0.002 f/cc to a single sample maximum of 0.3 f/cc. To determine if any of the fibers detected by PCM were asbestos in the sample with a PCM fiber concentration of 0.3 f/cc, the sample was prepared and analyzed using TEM. No asbestos fibers were detected in the sample.

In December 1998, 10 air samples were collected from perimeter locations during the December asbestos soil sampling program. TEM analysis of 10 high volume samples collected by LFR during the December 1998 sampling program did not detect asbestos fibers in the 10 samples. Therefore, the resultant TEM concentration for these samples was less than the detection limit of < 0.0002 f/cc.

In October 1999, ambient air samples were collected from 10 locations. For this round of sampling, air samples were submitted for TEM analysis only. TEM analysis results for October 1999 indicated no asbestos fibers greater than (>) 5 μm were detected in the air samples. Therefore, the concentration of asbestos fibers is less than the detection limit of <0.0002 f/cc for these samples.

Snow was not covering the ground during either the December 1998 or October 1999 sampling events. Thus, the results of the PCM and TEM analyses of ambient air samples collected reveal that the presence of any asbestos fibers in the soil, surface water, and groundwater at the Site are not impacting the air quality at the Site.

4.2.2 Personal Air Sampling

In addition to the 1998 and 1999 ambient background air sampling, personal air samples were also collected in December 1998 and January 1999 during two asbestos soil sampling programs. Results of the personal air sample analysis are presented in Table VIII.

PCM analysis of 18 air samples collected using personal air monitoring equipment in December 1998 and January 1999 reported total fiber concentrations ranging from 0.003 to a

single sample maximum of 0.170 f/cc. The maximum sample (0.170 PCM f/cc) was submitted for TEM analysis and no asbestos fibers were identified.

Snow was not covering the ground surface during either of the sampling events. Thus, the results of the PCM and TEM analyses of air samples collected during soil sampling events reveal that the presence of asbestos fibers in the soil and groundwater at the Site are not impacting the air quality at the Site.

4.3 Surface Water

Results of the surface water sampling are summarized in Table XII. Asbestos structures, identified as chrysotile, were detected in three of the four surface water samples collected and analyzed, in accordance with the EPA Drinking Water Method (EPA-600/4-83-043 (100.1)). In accordance with the drinking water method, an asbestos "structure" can be an individual fiber and/or a matrix of more than one fiber bound together. With one exception the structures identified in the surface water at Grace consisted of individual fibers.

This method reports results in two separate ways: (1) as a total asbestos concentration based on all structure sizes and (2) a concentration based on structures greater than 10 μm in length. This is because current health risk information indicates fibers greater than (>) 10 μm in length are more likely to impact human health.

The structures detected in the Grace samples are in the range of 0.5 to 5.0 μm in length. A total of 8 asbestos structures, less than 5 μm in length, were detected in the surface water samples from Jerry's Pond. The concentration of total structures detected was in the range of <0.18 MF/L to 0.7 MF/L (Millions of Fibers/Liter). No asbestos structures greater than 5 μm were detected in the four surface water samples. Since the detected structures were less than 10μm, the concentration reported for structures greater than 10 μm is <0.18 MF/L. Analytical data sheets are included in Appendix D of this report.

4.4 Groundwater

Groundwater samples were collected from three wells (B207-OW, B807-OW, and B503-OW) and analyzed for asbestos content during five groundwater sampling events conducted from October 1999 through May 2000. For each sampling round, groundwater samples were analyzed using the EPA Drinking Water Method (EPA-600/4-83-043 (100.1)). This EPA drinking water method is a TEM method for identification of asbestos with a detection limit reported in millions of fibers per liter (MF/L) with results reported as described above in Section 4.3. Table XI presents the results of the five groundwater sampling rounds. Laboratory data sheets are included in Appendix D.

Table 4.4 below summarizes the results of the five rounds of groundwater sampling.

Table 4.4

	NO. SAMPLES ANALYZED	N0. STRUCTURES < 10 Microns	N0. STRUCTURES > 10 Microns	ASBESTOS CONC. > 10 Microns
OCT 1999	3	5	0	< 21.4 MF/L
NOV 1999	1	0	0	< 0.18 MF/L
DEC 1999	1	0	0	< 0.18 MF/L
FEB 2000	2	5	0	< 0.18 MF/L
MAY 2002	1	3	0	< 0.18 MF/L

As previously discussed in Section 3, a lower detection limit from was achieved during the sampling events subsequent to the October 1999 sampling event (November, December, February and May) by filtering a greater volume of water through the filter.

Thirteen (13) asbestos structures (all individual fibers) less than 10 μm in length were identified. In one sample (B207-OW) one structure (a fiber) was identified at 6 μm in length, the remaining 12 structures were all less than 5 μm in length. The widths of the 13 structures varied from 0.05 to 0.25 μm. No structures greater than 10 μm in length were detected in the eight groundwater samples analyzed.

4.5 Sediment

No asbestos fibers were detected in the 10 sediment samples analyzed using the Region I Protocol combined with PLM. Sediment sampling results are summarized in Table XIII. Laboratory data sheets are provided in Appendix D.

4.6 Conclusion

4.6.1 Potential Source of Asbestos

Asbestos may have been used by Dewey and Almy at the Site in conjunction with pilot-scale operations in the 1930s. These pilot-scale operations would have involved a model production line for manufacturing a type of brake lining that was molded with asbestos and latex and are believed to have occurred in former Buildings 11 and 12. In the late 1960s and early 1970s, Grace conducted laboratory analysis and research on small amounts of asbestos-containing fireproofing materials. However, these uses of asbestos are thought to have been small in scale and likely did not result in a release of asbestos to the soil, groundwater or surface water at the Site.

The majority of the buildings formerly located at the Site, and a number of the current onsite buildings, were constructed in the first half of the 20th century and likely contained asbestos materials. It is probable that asbestos-containing material was used to insulate steam lines and boiler rooms in and around buildings that were eliminated as company operations were scaled back. Based on historic insurance maps, various buildings were also sided with asbestos containing materials.

The demolition of the former buildings, the degradation of the asbestos containing building materials, and releases of fibers from automobile brakes (a friction product) are likely the source of the low levels of asbestos present in the soil, groundwater and surface water at the Site, as is the case in many other urban settings. With the close proximity of the Grace Site to the nearby Routes 16 and 2, the Site has likely been impacted by low levels of fibers released during automobile braking. Fibers which settled on the roadways have potentially been transported to the Site soil and surface water via runoff from the roadways during storm events. A study of samples collected from street surfaces in California indicated that asbestos was found in approximately 80% of the samples tested (Pitt, 1988). The fibers identified were primarily chrysotile and the source of the fibers was thought to be release from automobile brakes.

4.6.2 Summary of Presence of Asbestos

The overwhelming fiber type identified at the Site is chrysotile, which is the most common form of asbestos used in building materials and friction products. Of the 74 samples analyzed by TEM (49-Grace/ASG, 25-EPA), 36 samples contained "trace" levels of asbestos, and 6 samples were determined to contain 1% or greater asbestos. Of the 42 samples with some detectable level of asbestos (Trace or %), chrysotile was identified in 40 of the samples. Actinolite was identified in 4 samples. Tremolite was detected in only one sample (ASG split sample AB2-22, S2) analyzed by TEM, at 0.15%. Actinolite (0.15%) and chrysotile (0.15%) were also identified in this sample. Neither the COC nor Grace submitted this sample for TEM analysis, however Grace did submit the sample for analysis using PLM. Results of the analysis indicated the sample contained 2% asbestos identified as chrysotile. This is the only sample of the 49 samples analyzed by TEM, as part of the sampling programs by Grace, COC, ASG, or EPA that indicates the possible presence of tremolite. Thus, this one possible identification of tremolite is considered to be an anomaly and not representative of Site conditions.

Haley & Aldrich concludes that based on the data collected and the historical use of the property, there is no reason to suspect that bulk disposal of asbestos has occurred at the Site. The data and historical use of the Site support the conclusion that the asbestos contamination at the Site is mostly due to the demolition of structures which had asbestos containing building materials.

5. LIMITS OF DISPOSAL SITE

Based on the results of this Phase II CSA, the limits of the disposal site for asbestos remain the same as existed prior to the detection of asbestos at the Site (i.e. for petroleum contaminants). Those disposal site limits include the 26-acre property owned south of Whittemore Avenue to Jerry's Pond, and the 1-acre One Alewife Center property. The disposal site does not include the Lehigh Metals / Babo's parcel, identified in the December 1998 program as Zone 5. The limits of the disposal site are depicted on Figure 2.

As previously described, the portion of the property known as the Lehigh Metals / Babo's Parcel was purchased by Grace in 1988 and was not occupied or used by Dewey & Almy or Grace during operation of the chemical manufacturing plant. This property was not included in the disposal site designated under Release Tracking Number (RTN) 3-0277, but rather has its own RTN and No Further Action status under the Massachusetts Contingency Plan. However, this parcel was included as Zone 5 in the December 1998 asbestos soil sampling program because it was a part of the property redevelopment plans which existed at that time.

PLM analyses of the 24 samples collected by Haley & Aldrich, COC, and ASG from this portion of the Grace property (AB2-326 to AB2-331 and AB2-335 to AB2-341, AB2-47 and AB2-48, Zone 5), indicated that "no visual asbestos" was detected in any of the samples. Additionally, Haley & Aldrich submitted one sample for TEM analysis (AB2-337, S2). TEM results indicated no asbestos was detected.

EPA collected 4 samples for PLM analysis on the Lehigh/Babo's Parcel (WRG-33 to WRG-36). PLM analysis of these samples indicated "no visual asbestos" was detected in the samples. EPA submitted two (2) of the samples for TEM analysis and results indicated "trace" levels of asbestos were detected in WRG-34 (0.0006%) and no asbestos was detected in WRG-36. As previously described in Section 4.1.7, the EPA observed non-friable SACM in the Lehigh/Babo's portion of the Site. The material found on this portion of the Site was not sampled. However, one soil sample (WRG-33) was collected on the Lehigh/Babo's parcel and submitted for PLM analyses by the EPA. The results of the analysis indicated no asbestos fibers were detected in the soil sample. As described previously in Section 4, on 11 November 2003 this non-friable piece of SACM debris was removed from the Lehigh/Babo's parcel by a licensed contractor (Environmental Solutions).

Based on the results of the laboratory analysis for the 28 samples collected in Zone 5 (24 - H&A, 4 - EPA) and the fact that debris is not known to be present at the Site, Haley & Aldrich concludes there is no evidence of a release to the environment in accordance with the MCP. Although, EPA detected "trace" level in one sample, the detection limit achieved by EPA (0.006%) is not sufficient to conclude that a release of asbestos fibers has occurred at the Lehigh/Babo's parcel. Therefore, Haley & Aldrich concludes that this portion of the property should be excluded from the Grace Site.

6. ENVIRONMENTAL FATE AND TRANSPORT

The fate and transport of asbestos fibers in the environment depends on the physical properties of the fibers, including size and shape, as well as the effects of the medium itself. Fate and transport are also influenced by human activity, site features, meteorological conditions, and hydrogeology.

6.1 Contaminant Physical Properties

According to the U.S. Geological Survey, asbestos is the name given to a group of minerals that occur naturally as masses of strong, flexible fibers that can be separated into thin threads and woven. These fibers are not affected by heat or chemicals and do not conduct electricity. For these reasons, asbestos has been widely used in many industries. Chrysotile, the fibrous form of the mineral serpentine, is the best-known type and accounts for about 95 percent of asbestos in commercial use. It is a hydrous magnesium silicate with the chemical composition of $Mg_3Si_2O_5(OH)_4$. The other types all belong to the amphibole group of minerals and include the fibrous forms of anthophyllite, amosite (also known as grunerite), crocidolite (also known as riebeckite), tremolite, and actinolite. Asbestos is very resistant to heat and pressure and it bonds well with many materials. Asbestos was formerly widely used in brake linings, gaskets, and insulation; and in roofing shingles, floor and ceiling tiles, cement pipes, and other building materials.

The predominant asbestos fiber identified at the Grace Site was chrysotile. Chrysotile has a density of 2.2 to 2.6 g/cm^3. The specific gravity of asbestos minerals is generally in the range of 3.0 to 3.3. Asbestos fibers are neither volatile nor soluble so their natural tendency is to settle out of air and water, and deposit in soil or sediment. However small fibers may occur in suspension in both air and water, and may be transported long distances (ATSDR, 2001).

6.2 Fate and Transport of Asbestos Fibers

6.2.1 Soil

The transport of asbestos fibers contained in soils to another medium or off the disposal site would be associated with the generation of dust, via wind erosion, from accessible or exposed surficial soil containing asbestos. Without soil disturbing activity, asbestos fibers are not mobile in soil. Asbestos in subsurface soil and/or surface soil beneath asphalt or buildings is not considered accessible under current site conditions, and subsurface excavation is not an ongoing activity at the Site. The remaining areas of the Site with surficial soil containing asbestos are generally covered with grass, sparse vegetation or surrounded by berms, such that wind in these areas is less likely to generate dust.

As shown on Tables VIII and IX, PCM analysis of samples indicated total fiber concentrations in air in the range of less than 0.002 to 0.30 PCM f/cc (< 0.002 to 0.30 f/cc). TEM analysis of air samples obtained around the perimeter of the Site indicated no asbestos fibers greater (>) than 5μm were detected (including in the sample with a PCM fiber concentration of 0.3 f/cc), in accordance with the NIOSH, OSHA and AHERA.

There are no published standards available for asbestos in ambient air. However, the detected PCM asbestos fiber concentrations are consistent with ATSDR Toxicological Profile for Asbestos (update), dated September 2001, indicative of urban background levels of asbestos in air of 3.0×10^{-6} PCM f/cc to 3.0×10^{-3} PCM f/cc.

Thus, the results of the PCM and TEM analyses of air samples collected both during soil sampling events and non-soil sampling events reveal that asbestos fibers in the soil at the Site are not impacting the air quality at the Site. Therefore, the TEM ambient air data indicates that no significant transport of asbestos from soil to air is currently occurring.

6.2.2 Groundwater

Groundwater flow at the Site is generally from the southeast to the northwest, towards Alewife Brook. Construction of the MBTA tunnel resulted in a groundwater divide in the central portion of the Site. Generally, groundwater on the north and northwest side of the divide flows west/southwest toward Alewife Brook. Groundwater to the south and southeast of the divide flows in a northeasterly direction toward the tunnel. Groundwater flow in the immediate vicinity of the MBTA tunnel is caused by the leak in the MBTA tunnel, which has locally caused a depression in the water table.

The migration of asbestos in the groundwater is not a likely scenario. No asbestos structures greater than 10 μm in length were detected at the Site (Table X). A total of 13 asbestos structures less than 10 μm in length have been detected in 8 groundwater samples analyzed from three wells at the Site from October 1999 to May 2000. The detection of such structures in the groundwater samples is likely attributable to suspended particles in the water sample and is not representative of actual groundwater conditions at the Site.

As indicated in Section 4.4, elevated levels of iron oxide particulates were present in the water samples. Well construction, development and sampling can create reducing conditions that will result in dissolved iron in the samples. The presence of iron oxide in 3 of the 5 sampling rounds suggests that even the use of low-flow sampling technique was resulting in artificially suspended particles in the groundwater samples, and thus structures, which normally would not be present, were found in the water samples. Five separate attempts were made to obtain a representative sample. On each occasion similar problems were encountered.

Asbestos is generally not considered to migrate with groundwater; however asbestos fibers may be suspended in groundwater in a similar manner to colloids. Colloids are small organic or inorganic particles, which can range from less than 0.1 μm to 10 μm in diameter. Of the 13 asbestos structures (each as individual fibers) detected in the groundwater, 12 were less than 5 μm in length and one was 6 μm in length. The widths of the 12 structures varied from 0.05 to 0.25 μm. Thus, in this case an asbestos structure can be viewed similarly to a colloid.

6.2.3 Surface Water

Asbestos structures (fibers and/or small matrices) may be transported to surface water by water erosion of surficial soils or runoff from the roadways during storm events. With the

close proximity of the Grace Site and Jerry's Pond to the nearby Route 16 and Route 2, the surface water in Jerry's Pond has likely been impacted by low levels of fibers released during automobile braking. Based on data collected on the Site, groundwater appears to flow into Jerry's Pond from the easterly and southerly direction. Of the four surface water samples from Jerry's Pond, a total of 8 asbestos structures (7 fibers, on matrix), less than 5 μm in length, have been detected in the surface water. The structures are not soluble in water. Overtime structures have and will continue to have the tendency to settle out of the water into the sediment at the base of Jerry's pond. With the exception of surface water runoff and direct rainfall, Jerry's Pond has no inlet or outlet. Because the pond is a closed system, there is no mechanism for the structures to migrate from the pond.

6.2.4 Sediment

"No visual asbestos" fibers were identified in the sediment samples collected from the banks of Jerry's pond. The sediment samples were analyzed in accordance with the Region 1 protocol combined with PLM. Asbestos is therefore not migrating to or from the sediments on the banks of Jerry's pond.

6.3 Potential Migration Pathways and Receptors

The properties in the immediate area of the Site are residential, with fewer commercial properties at a distance. The Red Line Alewife subway station occupies the central portion of the Site. No institutions (as defined by the MCP) are observed within 500 ft. of the site. There are no Areas of Critical Environmental Concern, Species of Special Concern, Threatened of Endangered Species Habitats located within 500 ft of the site. Protected Open Space (Local/State/Federal/Trustee) is located within 500 ft of the site.

Potential nearby environmental receptors include Jerry's Pond, Yates Pond, Parkway Pond and Alewife Brook. None of these water bodies are used as a public water supply. The site does not overlie a Sole Source Aquifer or a Potentially Productive Aquifer. The site is not proximal to a public drinking water supply source. There is a private water supply well within 500 ft at 12 Whittemore Avenue. The well was installed and developed in the bedrock to a depth of 960 ft to provide an alternative source of irrigation water for the nursery operation that exists at the location. The well has never had a pump installed in it. There are no current plans to activate the well. The site is not within the Zone A of a Class A surface water body and an Alternative Public Water Supply is available.

Potential human receptors include adult construction and utility workers on-site, adult office workers on-site, adjacent residents of all ages, and pedestrian traffic and trespassers through and at the perimeter of the Site on paved walkways, including pedestrian traffic walking to and from the MBTA station and children visiting the Site. According to W.R. Grace & Co.-Conn., approximately 450 people work at the Grace facility and 400 people work at Alewife Center for an approximate total of 850 on-site workers. The impact of the Site on these potential nearby receptors is evaluated in the risk assessment portion of the Phase II CSA. A summary of the Risk Characterization is presented in the following Section of this report.

7. SUMMARY OF RISK CHARACTERIZATION

7.1 MCP Imminent Hazard Evaluation

An Imminent Hazard Evaluation (IHE) was conducted as a result of detecting the presence of asbestos at the Site according to Section 40.0900 of the MCP and current risk assessment practice in Massachusetts. The purpose of an IHE is to evaluate the need for immediately undertaking response actions to prevent or abate exposures that pose an Imminent Hazard. An Imminent Hazard is a hazard that would pose a significant risk of harm to health, safety, public welfare or the environment if it were present for even a short period of time (310 CMR 40.0006). The IHE focuses on actual or likely exposures under current site conditions. The IHE conducted as part of the December 1998 program focused on risk of harm to health.

The exposure scenario of concern for actual or likely exposures to asbestos is the current or expected generation of dust, via wind erosion, from accessible or exposed surficial soil containing asbestos. Asbestos in subsurface soil and/or surface soil beneath asphalt or buildings is not considered accessible under current site conditions, and subsurface excavation (with the exception of periodic environmental sampling, which is conducted with a Health and Safety Plan) is not an ongoing activity at the Site. The majority of the Site is inaccessible due to the presence of fencing which restricts public access (Figure 2). Grace employees, working in the on-site buildings adjacent to the fenced areas, may randomly access these areas; however, given their activities (office workers), it is unlikely they would regularly venture outside the buildings in the areas containing asbestos. It was assumed they may occasionally be exposed to dust that could be generated by wind erosion while walking to and from buildings, or during walks they may take on breaks. In addition, since an athletic field (Russell Field), a bike path and an MBTA public transportation station (Alewife) are situated adjacent to or within the Site, but outside fenced areas, users of these facilities may also be exposed to Site dust that could be generated by wind erosion.

The IHE to human health considering the soil and air data collected through the December 1998 asbestos sampling program conducted at the Site concluded that an Imminent Hazard to human health does not exist at the Site. The air monitoring data, for which levels of asbestos were non-detect (to a range of detection limits <0.0002 to 0.004 f/cc for TEM analysis, indicate that no exposure is occurring (Section 4.2). In addition, it is deemed unlikely that exposure to airborne asbestos would occur under current site conditions and uses. This is because the available air monitoring data are considered conservative since the Site soil was being disturbed (on-going soil sampling) on the days of air monitoring.

Additionally, as described in Section 4.1.7, ATSDR reviewed the results of the EPA sampling program at Grace to determine whether the asbestos levels in the surface soils at the Site pose an immediate health threat under current site conditions and usage. ATSDR concluded that "the asbestos levels present in the surface soils on Site do not pose an immediate or long-term public health hazard" and that "Subsurface asbestos contamination does not pose an immediate health hazard as long as the waste remains buried, and is not brought to the surface."

7.2 Evaluation of Overall Site Risk and Comparison to Background

Evaluation of risk requires the determination of pathways of exposure and possible receptors under current and foreseeable future conditions. Exposure to asbestos fibers can occur via the inhalation and the ingestion pathway. Current receptors at the Site include on-site, adult office workers, utility workers and adjacent residents of all ages, pedestrian traffic and trespassers through out and at the perimeter of the Site. Potential future receptors include the same receptors, as well as construction workers; and such receptors have to be evaluated in light of the opportunity for soil disturbing activities.

The most critical route of exposure for asbestos fibers is the inhalation pathway. To undertake a quantitative risk evaluation for future conditions, numerous assumptions must be made, including the actual distribution of asbestos fibers throughout the soil mass, how these fibers transfer from the soil into the air and how they transfer from the immediate site area to the ultimate receptor. These assumptions have been made for the conduct of the quantitative Method 3 Risk Characterization. This risk characterization, included in Appendix F, was undertaken in accordance with the provisions of the MCP, and is summarized below in Section 7.2

For the current potential exposure of major concern, assumptions concerning the transfer of asbestos fibers into the air and transport to the receptors are unnecessary because of the availability of direct ambient air asbestos exposure measurements. The measured exposure concentrations can be compared directly to MCP criteria, and shown to satisfy them. Current inhalation risks associated with dust blown from asbestos in soil can be determined by direct measurement and evaluation of asbestos content in air at appropriate exposure points. Current air quality was determined by sampling the air to a detection limit of 0.0002 TEM f/cc for TEM analysis (See Section 4.2). Two rounds of perimeter air samples were collected at the Site in 1998 and 1999 and analyzed using the TEM Method. No regulated asbestos fibers were detected above the detection limit during the TEM testing events. A detection limit of 0.0002 TEM f/cc was achieved, and this concentration is consistent with values published in the ATSDR Toxicological Profile for Asbestos (update, Sept. 2001 of background levels of asbestos in air. Moreover, the detection limit of 0.0002 TEM f/cc obtained at the site corresponds to 3.3×10^{-6} PCM f/cc (using the approximate conversion factor of 60 TEM f/cc per PCM f/cc), lower than the DEP's Allowable Ambient Limit (AAL) of 4×10^{-6} PCM f/cc, again indicating no significant risk.

According to MCP (310 CMR 40.0902 (3)), if the concentration of an oil and/or hazardous material at the disposal site is at or below background levels, then that oil and/or hazardous material shall be considered to pose no significant risk. Thus, by definition, there is no current significant risk due to possible exposure to asbestos fibers in air at the Site.

In future, potential asbestos releases are prevented through the use of an Activity and Use Limitation (AUL) requiring best management practices and confirmatory monitoring in the event of planned soil disturbing activities.

7.3 Quantitative Method 3 Risk Characterization

Cambridge Environmental, Inc. has prepared a Method 3 Risk Characterization for asbestos at the Site, which is included in Appendix F of this Phase II CSA. .

DEP has also prepared a Memorandum, dated 31 July 2000, indicating that the 1988 risk characterization was no longer adequate for the Site, given the recent detection of asbestos in soil at the site. DEP further indicated that data for the Site (asbestos and new data for other contaminants) generated since the completion of the 1988 risk assessment and Phase II CSA (i.e. 1998 report entitled "Environmental Data Report") needs to be incorporated into risk calculations for the Site. In addition to the asbestos data now available for the Site, Haley & Aldrich had completed a soil characterization program for EPH and VPH, and a Bioremediation program to address elevated EPH levels (Section 1.4). This re-evaluation of total site risk, considering the new data for other contaminants and at the Site will be undertaken as a part of a Response Action Outcome (RAO) report, at the appropriate time.

The MCP requires that an assessment be made to determine if any current or foreseeable risk exists to public health, welfare, safety and the environment, as a result of the presence of asbestos in the soil at the property. In accordance with the MCP, the risks to human health, safety, public welfare, and the environment have been characterized for asbestos contaminated soil, groundwater, surface water, and ambient air at the Site and adjacent properties. Risks are explicitly estimated for current and future adjacent residents, adult office workers on site, the potential future construction worker on site, and the current and future utility worker on site. Visitors and transient users of the site (children and adults) are considered implicitly because risks would be less than for the adjacent resident, utility worker, or future construction worker. Exposure pathways evaluated quantitatively in the analysis are inhalation of airborne asbestos and incidental ingestion of asbestos in soil. Other pathways were examined and found to be incomplete.

The risk characterization concludes the following:

- Under current conditions of use as a commercial property, very little and perhaps no exposure to asbestos from the site occurs, because the top layer of surface soil does not contain significant concentrations of asbestos. This finding is supported by the air quality data assembled for the Site, and a similar conclusion was reach by ATSDR in their Public Health Consultation completed for the Site. Based on the measurements taken and evaluation of potential exposures, it was concluded that a condition of No Significant Risk exists under current Site conditions.

- For the foreseeable future, the Site is likely to continue to be used in a manner consistent with its current use as a commercial facility. In this case, risk estimates remain the same or decrease if the soil remains undisturbed or if any asbestos-containing disturbed soil is covered with clean soil. However, to be conservative and consistent with previous risk characterizations for the Site, the risk assessment considered a hypothetical future use scenario involving excavation of asbestos-containing soil that then remains on the surface. Under the hypothetical construction scenario, the incremental cancer risk estimates for the adjacent resident, the office

workers, and the hypothetical construction worker potentially exposed to soil at the Site exceed DEP's guidelines for achieving a condition of No Significant Risk. However, an activity and use limitation (AUL) could be implemented at the Site to maintain a condition of No Significant Risk during such hypothetical future activities. The AUL would require the development of a health and safety plan and a soil management plan during construction, and would also require that asbestos-containing soil be covered with clean soil after soil-disturbing activities.

- The characterization of risks to the environment concluded that exposure of environmental receptors to asbestos is limited. The characterization of risks to public welfare did not identify conditions that may negatively affect the surrounding community. Therefore, the risk characterization concludes that the site poses No Significant Risk to the environment or public welfare.

- The characterization of risks to safety finds that the asbestos present at the Site poses. No Significant Risk to Safety.

8. SUMMARY AND CONCLUSIONS

- Asbestos data collected during initial and Phase II stages of this investigation allow for the following conclusions to be made regarding soil, sediment, surface water, and groundwater quality, extent of contamination, and the limits of the disposal site:

- The Site is underlain by four soil types consisting of, (from ground surface downward), fill (1-10 ft thick), peat (0-12 ft thick), sand (12-38 ft thick) and clay (up to 137 ft thick). The fill is generally comprised of a gravelly sand, with varying amounts of brick, boulders, rebar, concrete, metal scraps, cinders, and asphalt. The building debris and other materials are present primarily as a result of demolition activities associated with the decommissioning of the former structures from 1976 through 1981. By 1981, the building layout shown on Figure 2 was scaled back to the present configuration of buildings owned by W.R Grace at the Site.

- Groundwater at the Site varies from 4 to 11 feet below ground surface. Regionally, groundwater flows in a north-northwest direction, towards Alewife Brook. Locally, this flow pattern is interrupted by the presence of the MBTA tunnel, which runs roughly east-west across the Site. Construction of the MBTA tunnel resulted in a groundwater divide in the central portion of the Site. Generally, groundwater on the north and northwest side of the divide flows to the west/southwest toward Alewife Brook. Groundwater to the south and southeast of the divide flows in a northwesterly direction toward the tunnel. The reversal of flow is caused by the leak in the MBTA tunnel, which acts as a groundwater discharge boundary and creates a depression in the vicinity of the leak.

- Since May 1998, a total of 882 soil and split soil samples were collected from the Site by Grace, the Alewife Study Group, and the City of Cambridge. Of the 882 samples analyzed, 833 samples (COC-33; Grace-745; ASG-55) were analyzed or reportedly** analyzed using the EPA Region 1 protocol combined with PLM (using EPA Method 600/R-93-116) and 49 samples were analyzed using TEM (EPA 600/R-93-116-Chatfield Semi-Quantitative).

  Based on PLM analysis, 678 samples contained no visible asbestos material, 84 samples contained asbestos at "trace" levels (less than 1%), 71 samples were determined to contain asbestos at 1% or greater. Therefore, 9% of the soil samples analyzed PLM contained 1% or more asbestos and 81% of the samples contained no visual asbestos.

  Of the 49 samples analyzed by TEM, 31 samples contained no asbestos material, 12 samples contained "trace" levels of asbestos, and 6 samples were determined to contain 1% or greater asbestos. Therefore, 64.6% of the samples analyzed using TEM contained no asbestos material and 12.5% of the soil samples contained 1% or more asbestos.

** Haley & Aldrich questions if the EPA Protocol was followed correctly for the 55 samples analyzed by ASG. However, to be conservative these samples are still included in the data set for the Site.

- No fibers greater than 10 μm in length were detected in the eight groundwater samples analyzed at the Site. The EPA's drinking water standard of 7 MF/L is based on fibers greater than 10 μm in length. The EPA drinking water method (EPA-600/4-83-043 (100.1)) was used to evaluate the groundwater for the presence of asbestos. Thirteen (13) asbestos fibers less than 10 μm in length were identified. In one sample one fiber was identified at 6 μm in length, the remaining 12 fibers were all less than 5 μm in length. The widths of the 13 fibers varied from 0.05 to 0.25 μm.

- No asbestos fibers were found in the 10 samples of sediment collected from the banks of Jerry's Pond. Samples were analyzed using the EPA Region 1 Protocol combined with PLM.

- A total of 8 asbestos fibers, less than 5 μm in length, were detected in the surface water of Jerry's Pond. Jerry's Pond has likely been impacted by the transport asbestos fibers contained in soils via water erosion, from accessible or exposed surficial soil containing asbestos. With the close proximity of Jerry's Pond to the nearby Route 16 and Route 2, the surface water in Jerry's Pond has also likely been impacted by fibers released during automobile braking, which settled onto roadways and were transported via runoff from the nearby roadways.

- The presence of asbestos contamination at the Site is most likely due to this historic use of asbestos containing construction materials. Over the years of facility operations there has been demolition of structures that likely had asbestos containing materials. The overwhelming fiber type identified at the Site is chrysotile, which is the most common form of asbestos used in building materials and friction products. The location of the Site is in an urban environment and in close proximity to the intersection of busy four lane highways. More than likely, asbestos fibers from the brakes of automobiles and trucks also have been deposited on the Site.

- Based on the ambient air monitoring data, asbestos fibers identified in the soil are not being released into the air. A majority of the Site soils are covered with pavement and or vegetation, thus fibers are unlikely to become airborne under current conditions.

- Asbestos fibers found in the groundwater samples are not believed to be representative of groundwater conditions at the Site. Fibers, which normally would not be present or moving with the groundwater, were present in the water samples. Their detection in groundwater is thought to be an artifice of the disturbance of groundwater and resultant sampling of suspended solids. Therefore, asbestos fibers in saturated soils are not thought to be migrating onsite or offsite in the groundwater and thus not leaking into the MBTA tunnel.

- Asbestos fibers identified in surface water are likely to settle into the sediment at the base of Jerry Pond. The fibers identified in the water will not become airborne. The pond is a hydraulically closed system. Therefore fibers identified in the surface water are not likely to migrate offsite except during extreme flood events.

- The limits of the soil portion of the disposal site for both asbestos and the previously evaluated contaminants (petroleum and naphthalene related) at the Site include the property owned by Grace south of Whittemore to Jerry's Pond. The disposal site limits do not include the former Lehigh Metals and Babo's properties, identified in the December 1998 sampling program as Zone 5. Based on the results of the laboratory analysis for Zone 5, Haley & Aldrich concludes that this portion of the property should be excluded from the Grace asbestos disposal site.

- Evaluations of site risk under existing conditions have resulted in a finding of No Significant Risk to human health, safety, public welfare and the environment. For the foreseeable future, the Site is likely to continue to be used in a manner consistent with its current use as a commercial facility.

- According to MCP (310 CMR 40.0902 (3)), if the concentration of an oil and/or hazardous material at the disposal site is at or below background levels, then that oil and/or hazardous material shall be considered to pose no significant risk. Asbestos fibers greater than 5 μm were not detected (to a detection limit of 0.0002 TEM f/cc) during the ambient air sampling events at the Site. This detection limit (0.0002 TEM f/cc) corresponds to 3.3×10^{-6} PCM f/cc (using the approximate conversion factor of 60 TEM f/cc per PCM f/cc), which is lower than background concentrations reported by ATSDR and the DEP's Allowable Ambient Limit (AAL) of 4×10^{-6} PCM f/cc. Thus, by definition, there is no current significant risk due to possible exposure to asbestos fibers in air at the Site.

- The risk assessment considered a hypothetical future use scenario involving excavation of asbestos-containing soil that then is allowed to remain on the surface. This evaluation was done to be conservative and consistent with previous risk characterizations for the Site. Under the hypothetical construction scenario, the incremental cancer risk estimates for the adjacent resident, the office workers, and the hypothetical construction worker potentially exposed to soil at the Site exceed DEP's guidelines for achieving a condition of No Significant Risk.

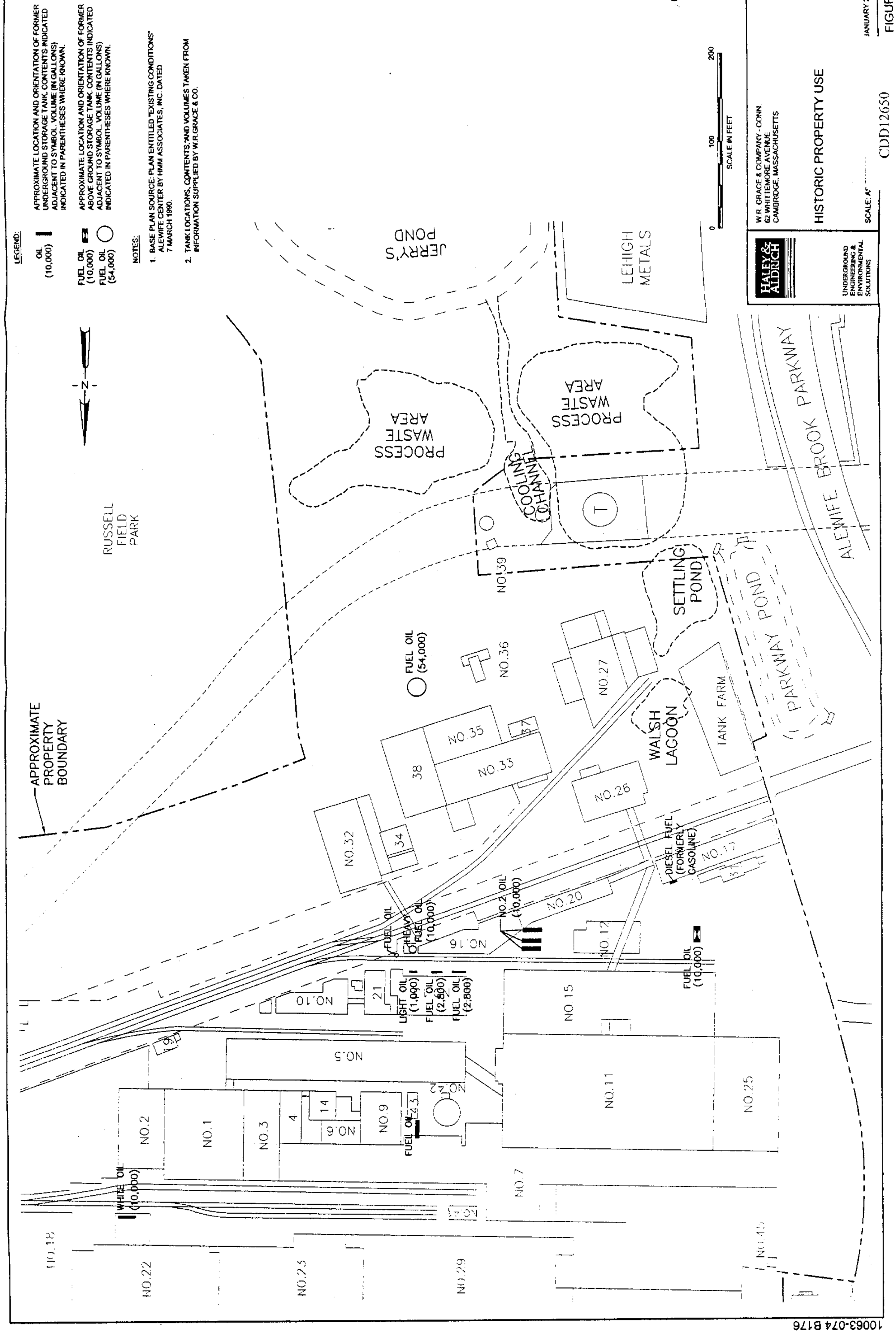
  However, an activity and use limitation (AUL) could be implemented at the Site to maintain a condition of No Significant Risk during such hypothetical future uses. The AUL would require the development of a health and safety plan and a soil management plan during construction and would require that asbestos-containing soil be covered with clean soil after soil-disturbing activities.

- The characterization of risks to safety find that the asbestos at the Site poses no Significant Risk to Safety.

9. LSP OPINION

William W. Beck, Jr. is the LSP for the project. The required LSP Opinion, seal and signature are provided in Block C of the BWSC-108 Comprehensive Response Action Form, an original of which is being submitted to the MADEP with this report. A copy of form BWSC-108 is included as Appendix A.

To the best of the LSP's knowledge, information and belief, it is the LSP's opinion that the response actions that are the subject of this submittal (i) have been developed and implemented in accordance with the applicable provisions of M.G.L.c.21E and 310 CMR 40.0000, (ii) are appropriate and reasonable to accomplish the purposes of such response actions as set forth in the applicable provisions of M.G.L.c.21E and 310 CMR 40.0000 and (iii) comply with the identified provisions of all orders, permits, and approvals identified in this submittal.


LEGEND:
OIL (10,000)
APPROXIMATE LOCATION AND ORIENTATION OF FORMER UNDERGROUND STORAGE TANK. CONTENTS INDICATED ADJACENT TO SYMBOL. VOLUME (IN GALLONS) INDICATED IN PARENTHESES WHERE KNOWN.
FUEL OIL (10,000)
FUEL OIL (54,000)
APPROXIMATE LOCATION AND ORIENTATION OF FORMER ABOVE GROUND STORAGE TANK. CONTENTS INDICATED ADJACENT TO SYMBOL. VOLUME (IN GALLONS) INDICATED IN PARENTHESES WHERE KNOWN.
NOTES:
1. BASE PLAN SOURCE: PLAN ENTITLED "EXISTING CONDITIONS" ALEWIFE CENTER BY HMM ASSOCIATES, INC. DATED 7 MARCH 1990.
2. TANK LOCATIONS, CONTENTS, AND VOLUMES TAKEN FROM INFORMATION SUPPLIED BY W.R. GRACE & CO.
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62 WHITTEMORE AVENUE
CAMBRIDGE, MASSACHUSETTS
HISTORIC PROPERTY USE
HALEY & ALDRICH
UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS
JANUARY 2004
FIGURE
CDD12650
APPROXIMATE PROPERTY BOUNDARY
RUSSELL FIELD PARK
JERRY'S POND
LEHIGH METALS
PROCESS WASTE AREA
PROCESS WASTE AREA
COOLING CHANNEL
NO.39
SETTLING POND
PARKWAY POND
ALEWIFE BROOK PARKWAY
FUEL OIL (54,000)
NO.36
NO.27
WALSH LAGOON
TANK FARM
NO.35
NO.33
38
37
NO.26
NO.32
34
DIESEL FUEL (FORMERLY GASOLINE)
NO.17
NO.20
NO.2 OIL (10,000)
FUEL OIL
HEAVY OIL
FUEL OIL (10,000)
NO.16
NO.12
FUEL OIL (10,000)
NO.10
21
LIGHT OIL (1,000)
FUEL OIL (2,800)
FUEL OIL (2,800)
NO.15
NO.5
NO.11
NO.25
NO.42
NO.2
NO.1
NO.3
4
14
NO.6
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FUEL OIL
WHITE OIL (10,000)
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NO.29
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10063-074 B176